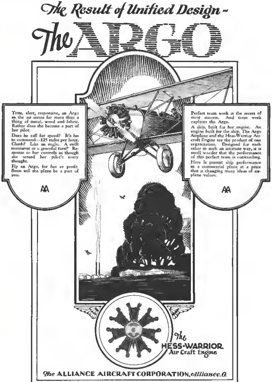
April 20, 1929 A McGraw-Hill Publication 20 Cents per Copy

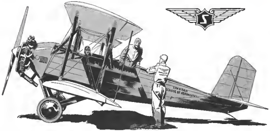
AVIATION

The Oldest American Aeronautical Magazine

AVIATION, April 20, 1929. Vol. No. 26 No. 16. Published weekly. McGraw-Hill Publishing Company, Inc., New York, N. Y. Domestic $4.00 per year. Canada $5.00. All other countries $6.00. 20 cents a copy. Entered as second class matter July 27, 1923 at the post office at New York, N. Y. under the act of March 3, 1879.



WHY SPARTAN TRAINING IS THE BEST



It Offers these Pronounced Advantages

New Planes

Spartan Training planes, powered only with nine-cylinder, radial, air-cooled motors, are used exclusively in the Spartan School of Aeronautics. Planes and motors are inspected regularly by Government-licensed mechanics.

Accommodations

One hundred yards from the school office are attractive living quarters, operated at cost by the Spartan school. Individual furnished rooms, recreational and reading room, hot and cold baths, parking space for cars, meals at the airport restaurant. An ideal arrangement at low cost.

Factory Facilities

Students at the Spartan School of Aeronautics have access to the Spartan factory for theoretical information of importance to the progress of their actual flying. In the factory, students may study aerodynamics and airplane structure in its various stages.

Army Instructors

The Spartan school instruction staff consists entirely of mature men holding transport pilot [the highest grade] government licenses, chosen because of desirable Army background and ability to impart knowledge to others.

A Great Airport

Tulsa's 400-acre municipal airport is the Spartan School training field. It has been laid out in accordance with modern, accepted airport requirements and is recognized as one of America's foremost municipal airport projects.

Aviation Center

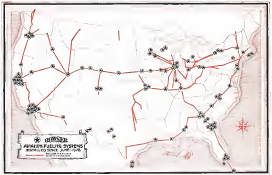
Four airports and a government meteorology station are factors involved in Tulsa's importance as an aviation center. From the Municipal Airport alone the air mail and three established passenger carrying lines, one using tri-motor Ford planes, operate to various points in the Southwest.

Write for full particulars.

SPARTAN SCHOOL OF AERONAUTICS

Municipal Airport .. Tulsa, Oklahoma

The stamp of approval



This map shows where Bowser equipment is already utilized for speeding up airplane service—for obviating ground hazards—for accuracy in fueling. It is quite obvious that the industry has given its unqualified approval to the Bowser system, for these installations have been made since June, 1926.

The Bowser way is to fuel planes direct from storage. A centrally located pit on the flying field houses an "Xacto" Meter and a fifty-foot hose for gasoline. There is a switch in the pit, controlling the operation of an electric motor in the hangar. Throw the switch and from then on you can deliver to any plane as many gallons of fuel as your storage tank holds, all in one continuous stream.

The gasoline is measured by an "Xacto" Meter so that deliveries may be accurately recorded. Air and water service can be handled in the same manner, from a central pit on the field.

The Bowser aircraft fueling system will deliver 20 gallons of gasoline per minute, which means that faster service can be given on a Bowser-equipped field than in any other way.

With speed as the keynote in aviation, your field should have the Bowser system. Write for details.

Fig. 230
Fueling
System

S. F. BOWSER & CO., INC.
1308 Creighton Avenue
FORT WAYNE, INDIANA

S. F. BOWSER & CO., Inc.
1308 Creighton Ave., Fort Wayne, Ind.
Please send me full details of the various Bowser airplane fueling systems.

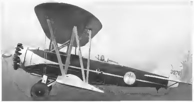
Name..

Address...

BOWSER AIRCRAFT FUELING SYSTEMS

The entry of Deep Rock into aviation is significant and full of promise. There is no factor in the petroleum industry with a better record of accomplishment or a greater store of material and personnel assets.

SHAFFER
OIL and REFINING COMPANY
General Sales Offices, 300 W. Adams St., Chicago



Boeing Mail Cargo Plane (Model 95)
The speediest, heavy payload commercial single-engined plane on the market

Boeing Announces:

The *new mail-cargo plane* that 3⅓ million miles of flying developed

SPECIFICATIONS:

Approved Type Certificate No. 106
Engine—Pratt & Whitney "Hornet" 525 hp.

PERFORMANCE
(With 1,610 Pounds Pay Load)

High Speed (Propeller Setting 16°)	140 mph
High Speed (Propeller Setting 17°)	142 mph
Landing Speed	56 mph
Rate of Climb (ft. per minute)	950 feet
Climb in 10 minutes	7,350 feet
Time to 10,000 feet	15.4 minutes
Service Ceiling	16,000 feet
Take-off Run	540 feet
Take-off Time	11.6 seconds
Wing Loading	11.9 lbs/sq ft
Power Loading	11.1 lbs/hp

DIMENSIONS

Span	44 feet 3 inches
Length overall	31 feet 11 inches
Height overall	12 feet 1 inch

WEIGHTS

Empty	3,196 pounds
Pilot	170 pounds
Fuel (130 gallons)	797 pounds
Oil (12.5 gallons)	97 pounds
Actual Pay Load	1,610 pounds
Gross Weight Loaded	5,840 pounds

This plane will be exhibited at the Detroit Aviation Show and a model will be sent on a tour of important cities

DESIGNED from experience gained flying 7,000 miles daily over "the longest airplane laboratory in the world" Model 95 proves itself in the forefront among mail-express-cargo planes by virtue of SPEED, HEAVY PAY LOAD, (1610 pounds), QUICK TAKE-OFF, LOW LANDING SPEED, ECONOMICAL OPERATION.

Other conspicuous advantages *of this outstanding plane* include: Operation equally well at sea level or 12,000 feet; at sub-zero or tropical temperatures; minimizes night flying difficulties; has rapid servicing features, added comfort and safety and visibility for the pilot, location of four mail-express compartments to obtain the maximum loading with rapid handling of pay load.

These are BUT A FEW of the advantages this new model offers operators seeking a dependable, economical, revenue producing cargo plane, which will be "on the job" every day.

Due to its superior performance over any other large capacity high speed carrier, Model 95 has been placed on the trans-continental air mail route, a merited indorsement.

OFFERED FOR IMMEDIATE DELIVERY

Boeing Airplane Company

Division of United Aircraft and Transport Corporation
Seattle, Washington

MOHAWK AIRCRAFT

"REDSKIN"

Ample space for two passengers and pilot with their luggage Beautifully finished in mahogany and red leather upholstery Powered with Warner "Scarab"

"SPUR-WING"

The sportiest plane in its price class and built with an eye to tomorrow's trend Two roomy cockpits, easily accessible Powered with Warner "Scarab"

MOHAWK, first to design and build the famous cantilever low-wing type monoplane in America, has spent hundreds of thousands of dollars in developing this exceptionally airworthy type of plane to its present state of efficiency and reliability.

The MOHAWK "REDSKIN" and "SPUR-WING" are outstanding achievements in aeronautical engineering. They combine safety, dependability and economy with comfort. Remarkably quick take-offs from small fields, handling ease in the air, exceptional landing controllability and maximum visibility are distinctive characteristics of these modern type planes.

The "REDSKIN" and "SPUR-WING," like the "PINTO," first of the famous MOHAWK Planes, are moderately priced. They are built on an efficient quantity production schedule, which materially lessens the production costs and allows them to be sold at proportionately lower prices.

Valuable territories are still available for reputable distributors and dealers. The MOHAWK Sales Franchise offers a profitable return. Complete information about the MOHAWK Line, including specifications and performance data, will be sent upon request. Wire or write for it today.

MOHAWK AIRCRAFT CORPORATION 2613 Delaware St. S. E., MINNEAPOLIS, MINN., U. S. A.

THANK YOU *for mentioning* AVIATION

A Vital Member of the Ground Crew

THIS man supplies protection that no safety device or skilled mechanic can provide. He is an expert in aviation insurance

As an agent of the Liverpool & London & Globe, he extends the greatest security you can find, backed by the world-wide record of this company and its casualty affiliations And he offers the greatest knowledge available in aviation insurance to day through the efficient service of Barber & Baldwin, Inc , the oldest established underwriters of aviation risks

Find out about the complete protection now offered you in *one* policy. Consult your local agent or write our aviation underwriting agents, Barber & Baldwin, Inc., Chanin Bldg , New York City

Complete Aviation Coverage in one Policy

Accidental Damage
Fire
Tornado, Cyclone and Windstorm
Theft, Robbery and Pilferage
Public Liability
Passenger Liability
Property Damage

Personal Accident
Compensation and Employers' Liability
Airport and Air-Meet Liability

Other forms of coverage Specially Constructed.

THE LIVERPOOL AND LONDON AND GLOBE Insurance Co Ltd

The National Institution With a World-Wide Background

Executive Offices:
1 Pershing Square, Park Ave at 42nd St. New York, N. Y.
Pacific Coast Dept., San Francisco, Calif

WYMAN-GORDON CRANKSHAFTS

Gulfpride Oil .. AMERICA'S FINEST AVIATION OIL....

The OIL EVERLASTING

This remarkable new aviation oil has been on the market but a few months, yet it has jumped into instant popularity with all those in aviation having to do with lubrication.

It possesses the following necessary characteristics:

1. High resistance to oxidation
2. Low carbon and gum-forming qualities
3. Low pour tests
4. Minimum change of body under extremes of temperatures

It is approved by leading aircraft builders.

In justice to your motor—your company and your passengers—you should use GULFPRIDE.

In sealed tins only.

Let us send you Free sample vial on request.

Gulf Refining Company
Pittsburgh, Pa.

the U·S·AIR MAIL

attests these facts by its use of

Pedrick

HEAT-SHAPED

PISTON RINGS

When the Air Mail Division, U. S. Post Office Department, inaugurated the Air Mail Service, PEDRICKS were chosen as piston ring equipment. The use of PEDRICKS by the Government-operated air lines was continued right up to the time when private contractors took over the service. Now many of the privately operated lines heve standardized on PEDRICKS.

This record of long-continued service in Air Mail planes surely demonstrates the *dependability* of PEDRICKS to an extent that no *single flight*, however famed, could prove. PEDRICKS hold compression and prevent oil pumping {spark plug fouling}—and continue to do so indefinitely.

Wilkening Manufacturing Co.
Philadelphia

No Modern Pilot's Training Is Complete

Without Instruction in a Closed Cabin Plane

The present wide-spread use of the closed cabin plane and the differences in flying this type and the open cockpit model, make it necessary that the modern pilot be able to fly both types.

The Curtiss OX-5 Robin is the only OX-5 powered cabin plane combining great ease of control, extreme maneuverability, clear vision, slow landing speed, and economical fuel consumption. It is this *exclusive performance* that makes the Robin the ideal closed cabin training plane.

Instruction in the Robin is included in the flying training given at Curtiss Flying Schools and others whose methods are modern and whose equipment is up-to-date.

Write for information and a copy of the booklet on our Flying School Course

CURTISS FLYING SERVICE, Inc.

New York Office
GARDEN CITY, Long Island
"—World's Oldest Flying Organization"

Sole Sales Agents for
CURTISS AEROPLANE AND MOTOR CO., INC.
CURTISS-ROBERTSON AIRPLANE MFG. CO.
SIKORSKY AVIATION CORPORATION
IRELAND AIRCRAFT, INC.

25 CURTISS FLYING FIELDS IN 1929

This means that there will be 25 fully equipped *service stations* giving expert mechanical service on every plane, engine or part made or sold under the Curtiss name.

Its also means that there will be 25 *flying schools* where prospective pilots learn to fly under experienced instructors, using the most modern equipment available.

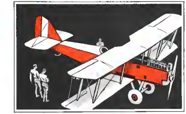
Thus is established—under the auspices of the finest and most highly organized flying service in the world—a nation-wide chain of aviation service stations, schools and centers where the public can follow the modern urge to fly.

"—World's Oldest Flying Organization"

CURTISS FLYING SERVICE, Inc.

New York Office—GARDEN CITY—Long Island

Sole Sales Agents for
CURTISS AEROPLANE AND MOTOR CO., INCORPORATED
SIKORSKY AVIATION CORPORATION   IRELAND AIRCRAFT, INCORPORATED
CURTISS-ROBERTSON AIRPLANE MFG. CO.



Increase the visibility of your plane

Color — rightly handled — *will increase the visibility* of your plane. Consult Sherwin-Williams Color Specialists. They will help you plan color combinations that will actually make your plane more readily seen at a distance.

Moreover, a pleasing color effect is now a strong factor in selling planes—sometimes surpassing in importance even a superior feature of the ship's construction.

Sherwin-Williams Aero Lacquer Enamels are clear, brilliant in color, and non-fading. They are unrivalled for producing the beautiful and distinct effects wanted on planes today.

These Aero Finishes are leaders in quality as well. Prominent manufacturers are adopting the complete line — including *protective coatings, primers, varnishes,* and *dope,* as well as *Aero Lacquers.* They find these finishes are far superior in lasting protection to the plane, in easy working qualities and economy in the shop.

Write us for a copy of the Sherwin-Williams A i r p l a n e Finish Color Card. Fill out this coupon for further valuable information.

THE SHERWIN-WILLIAMS CO.
Cleveland, Ohio
Largest Paint and Varnish Makers in the World

SHERWIN-WILLIAMS
AERO FINISHES

THE SHERWIN-WILLIAMS CO.,
Dept 701—601 Canal Road N W
Cleveland, Ohio

Please send me complete data on Aero Lacquer Enamel and other aircraft finishes

Name Business title

Address

City State

Endurance Test

"WHAT did I tell you, Bill? That bird with ·TP· will make it. The other fellow—not so good. I can't see why anyone wants to take a chance on a cheap oil when he knows for sure that ·TP· will deliver."

·TP· Aero Motor Lubricating Oils are new—the latest development in scientific lubrication. They have been tested and approved by leading manufacturers of airplane engines and by many leading pilots. They are straight-run oils, not blended or compounded, produced from pure, paraffine-base crude by a process for which patents are pending.

This process has marked advantages over other methods. It removes all the paraffine wax, while preserving all the lubricating bodies in the crude. Elimination of the wax is responsible for its low cold test.

In terms of performance this means uniform viscosity at all working temperatures, minimum carbon deposit and ignition trouble from fouled spark plugs, easy cold priming, immediate oil pressure, perfect lubrication winter and summer, on the ground or at high altitudes—a maximum of safe flying hours.

A handsome, practical *Pilot's Log Book* sent free on request. Please use the coupon.

·TP· Aero Rocker Arm Lubricant

A pure, paraffine-base, low-cold-test, mineral-oil lubricant. Free flowing—will not carbonize. Send 50c for 1-pint trial can.

TEXAS PACIFIC COAL AND OIL COMPANY
FORT WORTH, TEXAS
New York St Louis Los Angeles

·TP· AERO MOTOR LUBRICATING OIL
PATENT PENDING

Aviation 4 20 29

Texas Pacific Coal and Oil Company, Fort Worth, Texas
Please send me, without obligation, your Pilot's Log Book.

Name________________Address________________

Your Oil Dealer's Name________________

The new BULLET

4 PEOPLE and a DOG in the nearest approach yet to the flying wing.

Never has an airplane been built with lines so clean, or so capable of attaining great speed with low horsepower Weighing 1150 pounds, the 32 BULLET will easily carry a load of passengers, baggage and fuel equal to its own weight Phenomenally low fuel consumption is made possible by perfect streamline and light weight The low wing 32 BULLET with landing gear completely retracted deserves its name There are 5 points in which the new Eaglerock excels all other light transport airplanes—SPEED, LIGHT WEIGHT, FUEL ECONOMY, LOW LANDING SPEED, PASSENGER COMFORT Write for proof of statements and a list of prices that will be an agreeable surprise

ALEXANDER AIRCRAFT CO, 401 Alexander Industries Bldg Colorado Springs Colo

EAGLEROCK

AVIATION

The Oldest American Aeronautical Magazine

Earl D Osborn, *Editor*
James H McGraw, Jr., *Publishing Director*
R. Sidney Bowen, Jr., *Associate Editor*
Leslie E. Neville, *Technical Editor*
James P Wines, *Assistant Editor*
Herbert F Powell, *News Editor*
Charles H Gale, *Assistant Editor*
Charles F McReynolds, *Pacific Coast Editor*

CONTENTS

April 20, 1929
Volume 26 Number 16

McGRAW-HILL PUBLISHING COMPANY, INC.
Tenth Avenue at 36th Street, New York, N. Y.

James H. McGraw, Chairman of the Board
Malcolm Muir, President
James H McGraw Jr., Vice-Pres. and Treas.
Edward J Mehren Vice-President
Mason Britton Vice-President
Edgar Kobak Vice-President
Harold W McGraw Vice President
C. H. Thompson Secretary

Cable Address Machinist, N Y
New York Dist. Office 285 Madison Ave.
Washington National Press Building
Chicago, 7 South Dearborn Street
Philadelphia, 1600 Arch Street
Cleveland Guardian Building
St Louis Bell Telephone Building
San Francisco 883 Mission Street
London 6 Bouverie St. London E.C 4

Publishers of

Aviation, Electrical World, American Machinist, Bus Transportation, Electrical Merchandising, Engineering and Mining Journal, Coal Age, Chemical and Metallurgical Engineering, Radio Retailing, Food Industries, Electric Railway Journal, Engineering News-Record, Construction Methods, Power, Electrical West (*Published in San Francisco*), Ingenieria Internacional, American Machinist—European Edition (*Published in London*)

Copyright 1929 by McGraw-Hill Publishing Company, Inc.

SCINTILLA AIRCRAFT MAGNETOS

Are Selected Because of Their Dependability—Simplicity—Accessibility

The Kinner K 5

One of a number of American Aircraft Engines equipped with Scintilla Aircraft Magnetos

Scintilla Aircraft Magnetos are Standard Equipment on Aircraft Engines Built by

AEROMARINE CORP
ALLIANCE AIRCRAFT CORP
AMERICAN CIRRUS ENGINES, INC
AXELSON MACHINE COMPANY
BROWNBACK MOTOR LABORATORIES INC
CONTINENTAL MOTORS CORP
CURTISS AEROPLANE & MOTOR CO
KIMBALL AIRCRAFT CORP
KINNER AIRPLANE & MOTOR CORP
LE BLOND AIRCRAFT ENGINE CORP
LIGHT MFG & FDRY COMPANY
LYCOMING MFG CO
MAC CLATCHIE MFG. COMPANY
MICHIGAN SCREW CO
NATIONAL AERO CORP
PACKARD MOTOR CAR COMPANY
PRATT & WHITNEY AIRCRAFT CO
ROCKY MT. STEEL PRODUCTS, INC
SZEKELY AIRCRAFT CORP
THE AIRCRAFT ENGINE CORP
TIPS & SMITH INC
VELIE MOTORS CORP
WARNER AIRCRAFT CORP
WRIGHT AERONAUTICAL CORP.

The majority of modern American Aeronautical Engines are equipped with *Scintilla Aircraft* Magnetos

Parts Dealer Service Stations

CHICAGO, ILL., Illinois Auto Electric Co., 2450 Calumet Ave.
DETROIT MICH., Greenleaf Inc, 3127 East Jefferson Ave.
LOS ANGELES CALIF Pacific Airmotive Corp., 3417 Angeles Mesa Drive
NEW YORK CITY Manhattan Ignition Corp 206 W 68th Street
PHILADELPHIA PA., J W Parkin Jr., *Ignition Specialist*, 2231 N Broad St.
TULSA, OKLA, Magneto Ignition Corp., 304 E Second Street
W PALM BEACH FLA Sutcliffe's Automotive Electrical Service Co., Corner First & Olive Sts

Scintilla Aircraft Magnetos can be obtained for engines of from one to eighteen cylinders

SCINTILLA MAGNETO CO. INC.
SIDNEY — NEW YORK
Contractors to the U S. Army and Navy

ROBERTSON

has been an authority on hangars since war days . . . . . .

In
AMERICA
ENGLAND
SPAIN
INDIA
EGYPT
GREECE
CHILE
HAWAII·PANAMA
PHILIPPINES etc

WE PLACE at your command one of the world's most complete funds of knowledge about hangars and their construction.

Robertson engineers have been taking part in hangar construction since the beginnings of modern commercial aviation. They have been all over the world, learning invaluable lessons, witnessing and often participating in most of the notable experiments that have been made in methods of building and equipping hangars. They know, from actual experience, the things that will work, and the things that won't.

Such knowledge and experience in a field where there is still so much guess work and inexperience is invaluable.

These engineers have been able to apply to hangars a material that is much less costly than heavy construction . . . yet which will last three or four times as well as materials like unprotected metal. They have worked out definite methods for daylighting hangars so that even delicate motor repairs can be done efficiently indoors. They have established systems of ventilation that remove poisonous exhaust gases from hangars.

As a result of this knowledge, Robertson has become headquarters for hangar information. We are glad to have you consult Robertson engineers about any problem your airport may present. It will cost nothing and will not obligate you.

H. H. ROBERTSON CO., PITTSBURGH

Second largest airshed in the world—at Cardington, England. Robertson Protected Metal (RPM) used on the roof of this hangar RPM used also on the airshed which is the largest in the world.

ROBERTSON

Send for this Booklet on Hangars

The Robertson engineers have prepared a booklet which gives the reasons for and against various building materials, general information regarding justifiable costs, and illustrations of many types of hangars It is a clear statement of the world's last 12 years of experience with hangars. It will be of great value to anyone planning a hangar It will be sent without charge.

ROBERTSON

Has the Experience

THANK YOU *for mentioning* AVIATION

AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

April 20, 1929

Volume 26 | Number 16

Speed or Regularity

RAILROADS many years ago reached what seems to be the limit of speed from the practical operating standpoint With ocean travel there is an absolute definite limit beyond which any increase in speed is only achieved by a tremendous increase in cost The airplane alone has not yet reached the point where increased speed is practically impossible In fact there are almost limitless possibilities of increased speed with little increase in danger, especially when we consider that profit is determined not by the hours flown but by the miles covered during the hour

It would seem then that next to safety the only objective of an airline operator should be the achievement of greater speed This is essentially true, but on the other hand, the operator must be sure that his schedule is such as to allow for the minor delays which necessarily must arise A reasonable percentage of the increase in the speed which is being obtained with modern planes should be reserved for making up lost time, for bucking head winds, and for throttling the engine under normal conditions

With the increasing network of airlines it is becoming more important to keep up to schedules in order to make connections Airplanes excel every other vehicle in speed, but they still lag in the regularity of their scheduled operations In spite of the temptation to the contrary it would seem inadvisable to increase the speed of the schedules at a proportionate rate with the increase of the speed of the planes

//

High Speed

THE high speed record for land travel of over 230 m.p.h which was established by Major Segrave at Daytona was made possible through the research work done for aeronautical purposes Both the streamlining of the automobile and the light weight power produced by the Napier engine are the results of aeronautical research experimentation Aviation has thus begun to repay in part some of the debt it owes to the automobile, and those who have engineered automobile engines According to the rabid advocates of high speed automobiles a system of super highways will allow automobiles of the future to travel at average speeds of 120 m.p.h This would certainly be more exciting than traveling at that speed in an airplane.

//

Pooling Patents

COMMERCIAL manufacturers of airplanes have not bothered much about patents The truth is, that up until last year, there have not been enough commercial planes to make it worth while for the owners of patents to do any suing. Commercial manufacturers have thus been lulled into the belief that no one would bother them about patents and most of them do not know what patents, if any, they are infringing

Among the suppliers to the Government, the situation was different and, to avoid disastrous patent litigation, during the War, patents were pooled under an association called the Manufacturers' Aircraft Association.

Since the War, the Association has continued to function and, on the whole, the patent situation has worked out more satisfactorily than in most new industries The general manager of the Association has been S S Bradley, and it is due largely to his quiet diplomacy that matters have run so smoothly Recently, the cross-license agreement has been revised, and under its new form, the license cost per plane has been lowered and put on a sliding scale The agreement pooling, as it does, some three hundred of the most important patents, frees the members from fear of suits for infringement It also makes a provision for the mutual use of new patents at a price to be set by a board of arbitration If manufacturers of commercial planes are to avail themselves of the inventions of others and avoid disastrous patent suits, they must become part of some such association There is nothing mandatory about joining the Manufacturers' Aircraft Association, but the Association has done fine work for military manufacturers and it is probable that the commercial manufacturers will find it expedient to join the Association

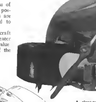
THE *Detroit Show* FROM A *Technical Angle*

By Leslie E. Neville

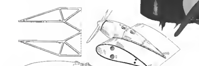
THE SECOND ANNUAL All American Aircraft show was particularly valuable from an engineering standpoint, in that it afforded an opportunity to study more than one hundred airplane designs as well as the details of a large number of engines and accessories Such a representation comes as nearly as possible to presenting an accurate picture of the status of aeronautical engineering

Development in aircraft design, like other forms of progress, is a process of evolution It is always possible, however, when a large number of airplanes are displayed, to note general design tendencies and to visualize the airplane of the future

A comparison with the first All American Aircraft show, held a year ago in the same city, shows a greater proportion of airplanes of proven commercial value It is interesting to note, however, that several of the designs then regarded as speculative, have taken their place among the accepted types



A close-up of the left engine of the Mohawk "Reeger" showing the "Rover" power plant mounted in a housing stream lined into the wing



Sketches showing the method of attachment of engine mounting to wing structure The gasoline and oil tanks are in the housing as shown

An attempt to simplify designs and mechanism with the ultimate idea of high quantity production was observable on one side and several of the features which cause production "bottle necks" have been eliminated On the other hand, there were a number of designs in which aerodynamic efficiency was considered before production possibilities

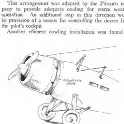
In almost all of the last mentioned cases, however, it is probable that production methods will be improved and volume increased to the point where manufacturing costs on highly efficient designs will not be prohibitive when a large number of units are to be built

The importance of aerodynamic cleanness in obtaining increased performance is being realized where, a year ago, engineers would invariably increase power to gain the same end Many creditable attempts have been made to reduce parasite drag and interference effects on the new models exhibited at Detroit

One of the most significant steps in this direction is the adaptation of the N A C A low drag radial engine cowling to airplanes and four of these were exhibited at the show Increases of top speed from seven to ten m p.h and even greater were reported by the manufacturers whose planes embodied this principle In most cases the cowling was made in halves, hinged together in such a manner that it could be removed without taking off the propeller The cowlings exhibited varied widely in interior design An interesting and useful modification of the cowling was found on the Pitcairn PA-6 biplane This consists of a telescoped section at the rear arranged to slide longitudinally and change the size of the annular opening between fuselage and cowling The sliding section may be moved to any desired position and is held in place by several bolts with wing nuts

This arrangement was adapted by the Pitcairn company to provide adequate cooling for warm weather operation An additional step in this direction would be provision of a means for controlling the device from the pilot's cockpit

Another efficient cowling installation was found on the "Cabinaire" biplane, exhibited by the Paramount Aircraft Corp In appearance this plane is particularly well adapted to the cowling installation This together with the special finishing process developed by the company, produced one of the most attractive exhibits of the show The cowling was so blended into the lines of the fuselage that it greatly improved the appearance of the plane and removed the machinery look that so obtrudes itself on the eye in the average radial engined plane



A drawing showing the telescoped section of the N A C A type of cowling installed on the Pitcairn PA-6

Front quarter view of the "Cabinaire" biplane with the N A C A. type of radial engine cowling

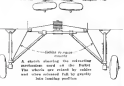
Tapered wings are coming into more general use and more originality is being shown in the development and choice of wing sections Judging from the planes exhibited at Detroit, cantilever wing types are becoming popular and thicker wing sections are being used, providing greater spar depth and structural strength

Although wood is still the predominating structural material in airplane wings, several of the new planes at the show had metal wing structures and two made use of both steel and aluminum alloy Another craft utilized fibre in the structure of the wing These will be described in greater detail later Several combination wood and metal wing structure also were employed

For manufacturers using spruce as structural material in wings, an interesting and efficient arrangement has been worked out by the Posey Manufacturing Company By this arrangement the Posey Company contracts with the airplane manufacturer to furnish complete sets of spars, ribs or both, finished to the specifications of the aircraft manufacturer and ready for assembly This eliminates not only waste of raw material but uncertainty regarding the proportion of suitable airplane spruce in any given shipment, which is sometimes widely variable A number of leading manufacturers are taking advantage of this service Several of the finished products were exhibited at the Hotel Statler in Detroit during the show

An interesting metal wing structure was noted in the PT-6 cabin biplane developed and exhibited by the Cunningham-Hall Aircraft Corporation, of Rochester, N Y This plane is one of the type having upper wings mounted flush with the top of fuselage, has a gross weight of 4,000 lb and is powered by the 300-hp Wright J-6 engine Wing ribs are of Warren truss type of $\frac{3}{8}$ in. O D. 028 in wall duralumin tubing, heat treated, with special riveted joints The upper wing beams are of one truss type, comprising upper and lower longitudinals of $1\frac{1}{2}$ in, O D by 049 in wall chrome molybdenum steel tubing, heat treated to 125,000 lb per sq in The upper longi-

tudinal is reinforced for a considerable distance at the outer support by a $1\frac{3}{8}$-in O.D 058 in wall chrome molybdenum steel tubing likewise heat treated The longitudinals are spaced by double vertical and diagonal members These members are bolted to the longitudinals by 5/16 in bolts and 7/16 in spacer tubes Drag trusses in the planes of both upper and lower longitudinals are used and compression struts are $\frac{7}{8}$ in 057 in wall heat treated duralumin tube Warren trusses Aileron



A sketch showing the retracting mechanism used on the Bullet The wheels are raised by cables and when released fall by gravity into landing position

hinges are located at compression strut points and ailerons structures are of No 1025 carbon steel

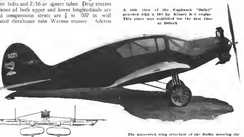
An unusual production feature is found in the fuselage construction of this airplane. Longerons are squared at the joints by means of a punch press, thereby avoiding the usual curved bevel joints of the abutting members and greatly facilitating production The PT-6 will be described in greater detail in an early issue of AVIATION

The second example of duralumin and steel wing structure was that of the Cirrus powered British Blackburn "Bluebird," biplane which is soon to be produced in this country This construction consists essentially of steel spars and duralumin ribs and fairing Rivets and bolts are used throughout and there are no welds in the primary structure This is also true of the fuselage structure, which is steel tubing with duralumin fairing members

A duralumin wing structure is embodied in the design of the LeBlond powered Barling NB-3 low wing monoplane, developed by the Nicholas Beazley Airplane Co This structure consists mainly of a large duralumin box member. Dihedral wing tips is another feature of this interesting design Several planes having stamped aluminum alloy ribs with wooden spars also were exhibited

Among the interesting new designs seen at Detroit was the Eaglerock "Bullet," developed by the Alexander Aircraft Corp The Bullet is a four place, low wing, full cantilever cabin monoplane with landing gear

A side view of the Eaglerock "Bullet" powered with a 100 hp Kinner K-5 engine This plane was exhibited for the first time at Detroit



The uncovered wing structure of the Bullet showing the unusual construction and internal bracing

retractable in flight, and is powered with a 100 hp Kinner K-5 engine The plane has a wing span of 38 ft 7 in, an overall length of 21 ft 7 in, a weight empty of 1150 lb and a gross weight of 2250 lb It is also available with the 165-hp Wright J-6, engine

The Eaglerock Bullet represents a step in the direction of the "flying wing" type of craft which is now being developed abroad The wing consists of three units, i e two panels and a center section Contrary to conventional practice, most of the important loads are borne by the steel tube center section of the wing The fuselage carries engine and tail loads and provides a streamlined housing for the passengers All wood box spars and ribs having fibre in shear only are employed in the wing panel structure

A specially derived airfoil section is used and a long elliptical taper reduces induced drag

The landing gear mechanism is simple and consists essentially of a drum and cables that draw the wheels up into streamlined compartments in the under side of the fuselage By releasing a trigger the landing gear can be dropped into position, falling by gravity It is kept in landing position by a double safety lock A hand wheel mounted on the front wing beam is used to retract the landing gear

The tail skid is a five leaf spring with an easily detatchable hardened steel shoe The entire assembly is pivoted to the fuselage and can be removed easily when necessary The rudder axis is set in such a position as to be vertical when the plane is taxiing on the ground or is a stall Entrance doors are set in the fuselage at such an angle as to be horizontal when the plane is on the ground. The stabilizer is adjustable by a triple screw thread

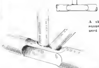
ANOTHER interesting design which made its first appearance at the Detroit Show was the "Ranger" exhibited by the Mohawk Aircraft Corp The Ranger is a three place low wing, cabin monoplane of the full cantilever type It is powered by two four cylinder in line air cooled "Rover" engines mounted in housings streamlined into the upper surfaces of the $4\frac{1}{2}$-ft center section panels These structures are built up of welded steel tubing, the longitudinals of the forward spars being 2 in by 085 stock. The welded steel tube engine mounting is attached to the wing structure by six bolts and four bolts are employed to mount each inverted engine Gasoline and oil tanks are located in the streamlined engine housings. Use of other power plants is made possible by the detatchable engine mounting

The Ranger has a wing span of 44 ft, a length of 26 ft, a gross weight of 2,000 lb and a useful load of 600 lb The tapered wing is of the internally braced full cantilever type A split type landing gear and a tail wheel are provided and both fin and stabilizer are adjustable in flight

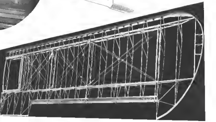
Cabin biplanes having upper wings supported on struts above the fuselage were fewer than at the Chicago Show but one new craft of this type was exhibited by the Knoll Aircraft Corp The Knoll KN-1 has a wing span of 33 ft 6 in, an overall length of 23 ft 3 in, a gross weight of 3,050 lb and a capacity of six persons It is powered by a Wright Whirlwind J-5 engine but also will be available with the 300-hp J-6 power plant

The KN-1 has a conventional fuselage structure and a wooden wing with plywood covering An innovation is found in the methods of mounting engine instruments and controls The engine instruments are placed on two small panels which are attached to the rear member of the engine mounting Controls for the power plant also are attached to the mounting, which is of the four point type and hinges to the fuselage in such a manner as to swing outward when repairs or adjustments are to be made to the engine When engine and mounting

A view through the incompleted fuselage structure of a Cunningham-Hall PT 6 cabin biplane

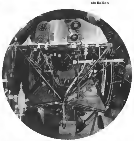


A sketch showing the squared longeron joints used in the construction of the PT 6



The wing panel structure of the PT-6 which is built up of steel tube spars and duralumin ribs

A front quarter view of the new Whirlwind powered Knoll KN-1 six place cabin biplane



A rear view of the engine mounting of the Knoll plane showing novel instrument and control installation

are in position the two instrument panels fit into cut outs in the instrument board which is mounted in the control compartment and contains the flight instruments. The control handles pass through a cut in the fire wall and are in the center of the space below the instrument board when the engine mounting is in position By this arrangement it is possible to connect all engine instruments and controls before the engine is placed in the plane and much time is saved in changing engines

That tail wheels are increasing in popularity was clearly shown at the exposition and a number of manufacturers who offer brakes as optional equipment are also offering tail wheels with the brakes A novel tail roller of almost spherical shape was installed on the "Carbinaire" plane at the show. Screw type adjustable stabilizers are becoming more common and many are actuated by cables or combinations of cables and push pull tubes

A combination skid and tail wheel was shown on the Fairchild 71, the skid being of the large broad shoe type with a small steel wheel mounted on the skid shoe in such a way that the plane can be easily rolled about in concrete floored hangars without the use of a dolly

Several original production practices are employed in the manufacture of the biplane exhibited by Fleet Aircraft Inc, one of the most interesting being the use of Parker-Kalon sheet metal screws to attach the fabric to the stamped duralumin ribs

REFINEMENT that will place aircraft in the same field as automobiles so far as public acceptance is concerned was evident in a few of the planes exhibited The new Verville Air Coach, particularly, has been nicely cleaned up and has no bracing members to mar cabin lines or vision from windows This plane is well streamlined even to the degree of carrying the fuselage lines back into the lower portion of the rudder, and is finished as tastefully and expertly as the finest automobile

That some order may materialize from the chaos of color schemes, which have heretofore been tried on various planes, was indicated by the Berry Brothers display with colored pictures of many popular airplanes One of the planes in the exhibit of the Hamilton Company had a Simonized exterior finish

An innovation in landing lights was shown by the Fairchild Company and consists of an asbestos lined compartment built into the leading edge of the wing with a window of glass curved to conform with the leading edge The light is mounted with a reflector only, the combination used being such that there is no need of a lens The result is a perfectly streamlined and well protected landing light which should prove to be an efficient unit.

A steady trend toward the monoplane in new designs is indicated by the showing of two more monoplanes than biplanes this year whereas there were considerably more biplanes than monoplanes shown last year The latest designs bear out the belief of engineers that there will always be a field for both the monoplane and the biplane with the future trend probably indicated by the large number of light sport and training planes of biplane type, while the transports are monoplanes The steps being taken by designers are further indicated in the presence at the show of seven folding wing airplanes, six low wing planes, three center wing planes and fifteen planes with wings of cantilever construction without any external bracing

The open plane led the closed in number of designs exhibited Despite the great opportunity for seaplanes and flying boats, there were less amphibians and seaplanes shown this year than last This may have been due, however, to the limited space, as at least two water craft were in the Detroit River during the show and could have been exhibited if space permitted The Eastman Flying Boat aopears to be a marked improvement over last year's model

Of the light tri-engined class, the Kreutzer Air Coach, powered with three LeBlond engines, was the only representative It is probable, however, that there will be more light multi engined planes in the future.

A considerable shift is evident in the seating capacity of the planes shown This is particularly noticeable because of the fact that three times as many two place planes were shown this year than in 1928 This indicates an effort to develop good sport and training planes to fill the need for craft upon which the great number of pilots now desiring experience may be trained

The three place open planes have not advanred in popularity, a lower percentage having been exhibited this year, but the three place closed plane seems to have gained favor for many monoplanes of this type were shown There is evident a tendency toward the four place plane providing a cleaner cabin interior than does that of the usual arrangement of a large number of seats Five place planes have decreased in numbers and six place have increased greatly in numbers shown An increased number of transport planes having capacities of 8, 10 and 12 persons was exhibited this year

Planes equipped with radial engines have almost doubled while those using the OX-5 have decreased more than 25 per cent This is partly due to the scarcity of OX-5 engines The engine problem in the 1,000 2,000 lb gross weight class has been met by the radials of 50-165 hp and by the four cylinder in line air cooled types Ten planes powered with in line air cooled engines were shown where there were no installations of this type last year Several very clean and attractive cowlings for this type of engine have been developed.

A comparative table showing the types exhibited in 1928 and 1929

	1929	1928
Total planes entered in Detroit Show	100	58
Monoplanes shown	48	24
Biplanes shown	47	31
Convertible biplane or monoplane	1	
Sesqui-planes	4	3
Open planes	53	31
Closed planes	47	27
Landplanes	95	31
Seaplanes or flying boats	3	4
Amphibians	2	3
Single engined planes	95	57
Twin engined planes	1	
Tri-motored planes	4	1
One place planes	4	1
Two place planes	32	11
Three place planes	29	27
Four place planes	11	2
Five place planes	5	9
Six place planes	6	3
Seven place planes	2	1
Eight place planes	3	3
Twelve or more place planes	3	1
Radial engines on planes shown	90	47
Vertical in line air cooled engines	10	
OX-5s	9	11
0 to 50 h p	3	
50 to 100 h p	32	
100 to 150 h p	18	
150 to 200 h p	14	
200 to 300 h p	11	
Over 300 h p	27	
1929 only		
Low wing planes	6	
Center wing planes	3	
Cantilever wing planes	15	
Folding wing planes	7	

Planes in the 1,000-2,000 lb gross weight range predominated in numbers and the increasing importance of the two place tandem sport and training types was very evident Two of these craft had single cockpit cut outs, the purpose being to facilitate communication between pilot and student In most of the low wing planes, greater protection is provided for the occupants

Among the engines exhibited, one of the outstanding tendencies seemed to be in the direction of supercharging, and built-in impellers were embodied in many engines in the medium horsepower ranges of radial types

A sketch of the new type of hollow steel propeller with a section of the blade cut away

Among the engines shown there were but three under 50 hp but the majority of the remainder were in either the 50-100 hp or above 300 hp classes, indicating that designers are attempting to develop more of the very light and very heavy engines, the medium classes being fairly well developed at the present time

AN AIR-COOLED "vee" type engine was exhibited by the American Aeronautical Corporation. This power plant develops 420 hp with a dry weight of only 694 lb Another Isotta Fraschini engine of particular interest was the type 80-T, a six cylinder in line air-cooled engine weighing 242 5 lb and developing 80 hp This power plant has the entire upper portion of the crankcase and all cylinders and fins cast in one piece with a separate head bolted to each cylinder The fins are thick and set far apart giving the engine a novel appearance in comparison with others of its type.

The four cylinder in line air-cooled type was represented by the Wright Gypsy, the Michigan Screw Company "Rover," American Cirrus and Dayton "Bear" engines One two cycle engine of novel design was exhibited by the Hurricane Motors Corp The new geared "Wasp" engine also was exhibited by the Pratt & Whitney Aircraft Corporation

A "one shot" lubrication system for rocker arms was installed on the Lycoming Model R-645 radial engine exhibited at the show This system is controlled from the cockpit and each rocker box supplied with oil lines running through the streamlined push rod housings

Among the features of the new Continental radial engine are a special lining bar for the counterbalances and a steel backed babbitted master rod bearing The lubrication system is such that there are no oil lines

Included in the power plant exhibits was a propeller of unique design This propeller, displayed by the Pittsburgh Screw & Bolt Corporation, was hollow, built up to two flat sections of S A.E 6130 chrome vanadium steel welded together and unusually well finished This propeller was tested recently by Lieut. Comdr C H Havill, U S N, at the plant of the Wright Aeronautical Corporation at Paterson, N J

LOOKING BACK AT THE *All-American Aircraft Show*

By R. Sidney Bowen, Jr.

THE second annual All-American Aircraft Show, recently held in Convention Hall, Detroit, was the largest presentation of aircraft, engines, and equipment ever made in the history of the aeronautic industry, yet its attraction to the public at large, as judged by the attendance, was not on a par with the attraction of the 1928 show. A total of 100 planes was exhibited and of that number 49 were land monoplanes, 47 were land biplanes, one was a seaplane, one was a seaplane amphibion, one was a flyingboat, and one was a regular amphibion.

The individual exhibits, as regards attractiveness of display, showed very little improvement over last year. This however, was not due entirely to the exhibitors. So great was the number of planes on exhibition that they had to be practically dove-tailed together, thus making it somewhat difficult for a visitor at the Show to walk about a particular plane and get a worthwhile view from all angles. There were, of course, a few exceptions to such a condition. The outstanding of these was the exhibit of Curtiss Flying Service, Inc. which showed a Curtiss "Fledgling" training plane, a Curtiss (Challenger) "Robin," a Curtiss (OX5) Robin, and two four-place Cessna monoplanes, together with Sperry beacons, etc. The layout of the Curtiss Flying Service display was unique, attractive and most effective. Grass matting covered the entire floor space, which was surrounded by a little white picket fence, and chairs in which the weary visitor could rest and get his breath were placed at strategic points about the display. That, incidentally, was an item that was most conspicuous by its absence at the Show. With things so "jammed" together, as it were, visitors had no place to rest and were forced to keep wandering about on the cement floor of the hall which dealt none too gently with one's feet.

IN FACT, it is believed that the absence of places to rest caused many visitors to leave before they had viewed all of the Show. Had there been some central spot provided with chairs, and perhaps an orchestra to render a bit of musical entertainment, it is almost certain that the Detroit Show would have made a far more favorable impression upon the visiting public and the visiting trade.

Two other examples of attractive and conservatively spacious display were the exhibits of the Great Lakes Aircraft Co., and the Chance Vought Company. The former had one of its Cirrus powered training planes mounted in flying position upon a revolving platform. Thus one could stand still and inspect the plane as it slowly revolved. The latter was markedly set off by the fact that it was a seaplane amphibian with silver and blue trimmings and its metal parts highly polished, with the exception of the float which was painted a blue-green. Both displays were roped off by blue felt covered rope which gave them the appearance of being separate and apart from the rest of the exhibits.

There were several other exhibits roped off in a similar manner, and although such an arrangement added a bit to the attractiveness of the display, it had its dis-

A view of the Westinghouse Electric Mfg. Co. booth and the Westinghouse Lamp Co. booth at the right

advantages as judged by watching the spectators roam about the Hall. The outstanding one was, that, to the less bold, it served somewhat as a "keep-off-the-grass" sign, with the result that the spectator viewed at a distance that which he would undoubtedly have liked to inspect closely. The suggestion is made that exhibitors in future aircraft shows arrange their displays so that the interested parties may have the opportunity to "see for themselves."

In the case of automobile shows, the visitor is allowed, in fact invited, to get into the car and see how the seat fits, try the gear shift, the clutch, the brake and various other things. However, at aircraft shows, the visitor has little chance to sit in a plane and manipulate the "stick" and rudder pedals as he desires. It is admitted that a plane is not an automobile and that a certain amount of damage can be rendered to the former by over-inquisitive spectators. Yet, on the other hand, as was clearly demonstrated at the Detroit Show, the public's interest in just looking at airplanes has waned considerably. Therefore the exhibitor should make provisions whereby the spectator can get into the plane on exhibit and actually work the controls for himself. It may mean that those in charge of the exhibit will have to be more on the alert, but they should be.

As a matter of fact, exhibitor attention to visitor was most conspicuous by its absence at Detroit. At an auto show one can hardly look at a car before some salesman steps up and asks if he may be of service in explaining about a particular car. Whereas at Detroit one could virtually stare at a plane until he was blue in the face before anyone in charge of the exhibit would offer any information. When the visitor at the Detroit Show wanted information he had to ask for it.

Perhaps that condition is partly explained by the fact that in many cases those left in charge of the plane displays did not know a great deal about their own product. In past shows the executives of plane companies were to be seen at their exhibits. At the Detroit Show they were either attending the one hundred and one different meetings and trade conferences at the various Detroit hotels, or else at the Ford Airport holding stop watches on competitive planes as they took off and landed. In short, the exhibitor managership of aircraft shows seems to have passed into the hands of ambitious and sincere yet rather uninformed young men. In other words, the second annual All-American Aircraft Show was really eight days of trade conventions with an aircraft show used as a means of concentrating the executives of the industry at one point for a certain period of time. It has been estimated that ten times as much business was conducted behind closed doors in the three leading hotels of Detroit than was conducted inside of Convention Hall.

Above: The Great Lakes training plane mounted in flying position upon a revolving platform

THAT SUCH an amount of business should be conducted outside is altogether satisfactory, but the aircraft and engine manufacturers should realize that it is the public that ultimately buys airplanes and engines. When a prospective customer visits an aircraft show, asks a question of some chap in charge of an exhibit, and receives the replay that — "I am sorry but I can not answer that, but Mr. So and So may be here later, and he can tell you" — that prospective customer is not going to come back to see Mr. So and So, nine times out of ten. Of course, it is not necessary that Mr. So and So be chained to an exhibit, but it *is* advantageous if at all times there is some one who *can* answer a customer's question. And, incidentally, not only be prepared to answer questions, but to *volunteer information*.

Another item lacking at the Detroit Show, and one which was also lacking at the 1928 show, was uncovered displays. Out of the 100 planes exhibited there were

Right: The Pratt & Whitney Aircraft Co. booth showing a geared and a direct drive "Wasp," and a geared and a direct drive "Hornet"

not even half a dozen stripped fuselages and wings As evidenced by the crowds that did inspect the few uncovered wings and fuselages, it is our belief that that is an important factor in aircraft shows that is being overlooked by the majority of exhibitors It not only gives the prospective dealer and distributor opportunity to inspect the good workmanship of a product, but it also gives the layman and prospective retail customer a chance to note the sturdy and well-knit construction of the modern airplane

That fact is also true regarding aircraft engines Believe it or not, there are many members of the aircraft

A three Pratt & Whitney "Wasp" engined Fokker F10 transport monoplane in flight

industry to whom the inside parts of a radial engine are in a certain sense a complete mystery At the Wright Aeronautical booth they and the public alike were able to view a cut-away Whirlwind in operation and see what it was all about One or two other engine manufacturers also exhibited cut away models and the crowds about them indicated their value to an aeronautical exhibit

While the arrangement of accessory and equipment exhibits was an improvement over the 1928 show, the individual exhibits did not show off to any great advantage One of the reasons for that was the relatively small amount of space taken up by each exhibitor Another was the noticeable absence of "working" models There was, perhaps, an increase in the amount of literature over the 1928 show, but it is sincerely hoped that aircraft show exhibitors, particularly airplane exhibitors, will do more about reading material in the future

One complaint that was heard quite frequently among the exhibitors was directed at the army of small boys who visited the show and endeavored to walk off with everything that was not nailed down To a certain extent the complaints are justified A small boy at an aircraft show is, figuratively speaking, in his heaven, and he will try to get hold of everything he can, and perhaps pester the exhibitors with what may appear as foolish questions On the other hand, it is that type of boy who will be buying planes when he grows up, or else become actively engaged in the industry itself. Whatever we can do for them now is, in a sense, building for an even better aircraft industry in the future

To alleviate the "young boy congestion" that existed at the Detroit Show, it might prove worth while to set aside two afternoons during which, boys under a certain age could be admitted unaccompanied by an adult During other times they would not be admitted unless they were with an older person On the two "open" afternoons the exhibitors could watch their exhibits for "raids," and at all times be ready and willing to answer those "foolish" questions, and thereby give a boost to some ambitious chap

Not least among the plane exhibits that attracted the attention of the visiting public and members of the trade were the Fokker, Stout and Kreutzer displays which were grouped together in one section of the Hall Here the layman was able to get a closeup view of the most modern means of commercial transport, and thousands of noses were pressed against the glass windows to get a better view of the inside of the passenger quarters

A cross-section of the cabin of the forthcoming new Fokker 32 passenger transport attracted all kinds of attention as it was so arranged that the visitor could walk right through and actually touch things In addition to sleeping berths, etc there were chairs so arranged about a little wall table that the air travelers could pass the time of day with a few rubbers of bridge A remark was made by one visitor that aerial bridge had its advantages in that when the bidder saw that he was unable to make his bid he could signal the pilot who would immediately go into a steep vertical bank, spill the cards on the floor and thus make necessary a new deal

One rather interesting fact regarding the Detroit Show was that there were more planes at the Ford Airport than there were inside Convention Hall A trip to the Ford Airport was an aeronautical education in itself, as there one found almost every type of airplane imaginable, and most of them in the air at one time or another. Had there been some means whereby each visiting plane was assigned to a certain part of the tarmac it would have helped materially in locating the various pilots and planes And had there not been such an apparent whole-

The booth of SKF Industries, Inc Note the SKF equipped geared Hornet" engine on the left and the Wright J6 on the right

sale breaking of the Ford Airport flying regulations it is quite possible that more plane prospects would have consented to demonstration flights

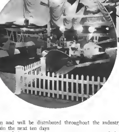
Although there were innumerable manufacturer and dealer meetings and other closed meetings held at various times during show week, there were several public meetings that proved to be of considerable interest to all present What appeared to be the most important from the standpoints of subjects discussed and attendance was the flying school conference held on the morning of Friday, April 12

For some time a committee headed by Phil Love, has been studying the flying school situation in this country

and cooperating with the Aeronautic Branch in an endeavor to straighten out school problems and place them upon a more sound and practical basis In order to do this it was decided to give Department ratings to all schools as being Approved or Unapproved schools Therefore a set of regulations governing the operation of approved schools was drawn up, and it was that set of regulations which was presented to the members of the industry at the Friday morning meeting, in order that they might offer suggestions or criticism as they saw fit The regulations are now being printed in mimeograph

Below A section of the attractively fenced in exhibit of Curtiss Flying Service Inc

Right: The booth of Northwestern Airways, Inc Note the scale model planes on the table



form and will be distributed throughout the industry within the next ten days

One of the more important requirements stated that a school applying for Department approval be classified as Private Pilot, Limited Commercial Pilot or a Transport Pilot school A second was the equipment to be used by each type of school In this respect it was stated that there should be at least one plane for every 15 enrolled students and that approved schools could only operate from a field where there were 100 acres for every 10 planes flying off that field

Another regulation was that every instructor must be a transport pilot at least and that the flying instructor's rating would go along with his transport license In other words, be renewed at the same time and subject to the same cancellation reasons as a transport license No instructor of an approved school is to be allowed to instruct for more than a period of six hours per day There was considerable discussion regarding that point, as it was believed by many that a maximum of six hours was too much Mention was made of the fact that three hours was the maximum in the Air Corps, and that the ruling as it stood would make it possible for a non flying school owner to force his instructors to spend six hours per day in the air with a student On the other hand, it was pointed out that a school owner would not take the risk of losing equipment by keeping a tired out instructor at work As the result of the discussion it is possible that the maximum of six hours may be reduced somewhat in the final regulations.

The maximum times to be allowed for the completion of the various ground and flying courses were stated as follows:

Private license: Twenty-five hours of ground work, 10 hr dual and eight hours solo All to be completed in three months if the school is to recommend the student for Department examination

Limited Commercial Fifteen to twenty hours dual, and 10 hr of the required solo time must be on a cabin plane and other than the training plane. Fifty hours must be spent on ground work and the entire course completed in six months

Transport: Thirty-five to fifty hours dual. Ten hours of the required solo time must be spent on other than the training plane, and 10 hours of the solo time must be spent on at least a four place cabin plane A total of at least 100 hr ground work is required and the entire course must be completed in 18 months

In order to hold a Department approved school rating the school must have 66⅔ per cent of its recommended commercial pilot's license students qualify, and 90 per cent of its transport license recommendations qualify Department inspectors are to begin rating approved schools on May 15 Information regarding other meetings held during the Show will be found in the news section of this issue

In summing up the Detroit Show and "convention week" it might be stated that with the facilities provided the Show officials did a rather good job Had they provided places to rest, a little music and, by all means some way of finding the various exhibits, etc, that would have all helped And had the exhibitors paid more attention to the visitors, and undoubtedly prospective customers, that strayed by their booths, their financial return from the Show would probably have been considerably greater than it really was Just what the financial value of the Show was to the various exhibitors is a matter for considerable speculation, in view of the fact that many of the sales announced during the Show were arranged for before the doors of Convention Hall were open on Saturday evening, April 6

Export SALES *Budgets* for AIRPLANE MANUFACTURERS

By Wesley Fowler

CONSIDERABLE thought is being given by United States aircraft manufacturers to the amount of money which can be spent for selling purposes. Production schedules have been drawn up and from all indications the total number of planes which will be produced in the United States during the current year will be approximately 8,000. It is believed that during 1930 a production figure of 10,000 will be reached (These are conservative estimates, there was talk of a production of 8,000 for 1928 early last year and the talk now is of 10,000 for 1929.)

Few manufacturers have considered what the foreign market will absorb in the next few years and the aircraft industry, therefore, is at a loss to know how far it can go in spending its hard-earned cash for foreign advertising, demonstrations abroad and for general pioneering to get its share of foreign business. It is reasonable to believe that 10 per cent of the United States aircraft production will be exported, which would indicate that of the 8,000 airplanes produced during 1929, 800 should find their way overseas and to the bordering countries. Our factories have been so absorbed with problems of production, and some with meeting the demand within this country, that little or no energy has been exerted toward obtaining foreign business. Of the 4979 military and commercial planes produced during 1928 only 170 planes were exported—about four per cent—and most of these were sold more by accident than design. During the latter part of last year a few of the larger manufacturers became interested in the possibilities of foreign business.

They, however, have been working largely in the dark because there has been a lack of adequate data and practically no precedent upon which to base their activities. A few occasional foreign orders have come to them as the result of efforts of American Consuls and the Bureau of Foreign and Domestic Commerce.

AN ATTEMPT will be made here to analyze the business obtained from abroad in the past four years and to budget what may be expected in the way of business during the next two years from the various countries not actively restricting the importation of American aircraft. In this last connection, there are certain countries now restricting the importation of our aircraft which are expected to lift the ban within a short time. These markets, therefore, will be included among those for which market expectations are forecast.

It should be stated here, that it is impossible to budget foreign business in the same way that production and domestic sales quotas are calculated, namely, on the basis of the quota clauses contained in distributors' and dealers' contracts. The few foreign distributors for airplanes have been found to be reluctant about signing a contract which embodies a quota clause, and it is believed that some time will elapse before market absorption in foreign countries can be estimated upon the basis used in this country.

The following analysis is strictly of a tentative nature, with accent on the tentative, because of the many ramifications entering into foreign marketing, such as the varying financial conditions of the respective countries, the unforeseen restrictions which may be placed against our aircraft, etc. It is believed that the following survey will have a practical application toward solving the export problems of the individual manufacturer. For example, if one plant schedules a production of 800 aircraft for 1929 and the total airplane exports from all U. S. factories during that year are 800, or ten per cent of total estimated production, that manufacturer (who should export 80 airplanes if he is to get his share of foreign business for the year) would like to know on what foreign markets to concentrate, where to send representatives and demonstrators and where to place his foreign advertising. The following sales forecast by countries is based upon exports of airplanes from 1925 to 1928, inclusive, and data obtained from the files of the Aeronautics Section of the Bureau of Foreign and Domestic Commerce, Department of Commerce, on market conditions both favorable to and militating against the importation of American airplanes. The estimated takings of certain countries may seem unreasonably optimistic. It is believed, however, that a market exists in each country for the approximate number of planes listed for each. Results during the next few years may not bear out these figures but by adequate and appropriate sales effort an individual manufacturer should sell at least his share to each market listed. This share would be on the basis of the percentage of a specific factory's production to total production, i.e., if 800 airplanes are produced by one factory, 80 should be exported, 40 airplanes are budgeted as total sales to Brazil during 1929, therefore, this manufacturer should sell at least 4 of them.

By grouping the countries geographically (Fig. 1) we find that Latin America, including Mexico, the West Indies and Central and South America absorbed 70 per cent of the exports (exclusive of those to Canada); that the Far East including Australia absorbed 20 per cent and Europe 10 per cent. Canada, which is considered by most manufacturers, even of products other than those aeronautic, as part of the domestic market, should continue to be an excellent field.

FIG. 1—U. S. AIRPLANE EXPORTS

Country of Destination	Total for 4 Years*, 1925 to 1928 Inclusive: No.	Value	Average Value in 1,000 s of Dollars	Total for 1928*: No.	Value	Average Value in 1,000 s of Dollars
Canada	120	$984,601	8.5	20	$766,644	10.9
Peru	41	596,556	15.7	26	266,360	10.3
Argentina	37	270,165	7.3	5	55,052	11.0
Mexico	54	279,609	6.2	21	191,635	9.1
Brazil	17	144,604	8.5	5	66,540	15.5
Cuba	16	163,049	10.2	4	54,897	15.7
Australia	15	74,023	4.9	7	50,872	2.3
Philippine Islands	13	188,659	14.5	2	34,500	17.2
United Kingdom	11	48,456	4.4	4	24,526	6.1
China	9	102,175	11.4	9	102,175	11.4
Chile	8	215,500	27.0			
Colombia	5	117,019	23.4	1	19,250	19.3
Japan	5	112,112	22.4	3	63,000	21.0
Belgium	4	39,103	9.7	1	4,185	4.2
Siam	4	38,400	9.6	4	38,400	9.6
Nicaragua	4	17,059	4.2			
Honduras	3	18,350	6.1	1	9,000	9.0
Netherlands	3	12,075	5.7			
Salvador	3	12,988	4.5			
Italy	2	84,950	42.5	2	84,950	42.5
Bermuda	2	4,850	2.4	1	2,050	2.9
Austria	1	20,000	20.0	1	20,000	20.0
Neth. E. Indies	1	11,750	11.8			
French Oceania	1	6,000	6.0	1	6,000	6.0
Venezuela	1	5,525	5.5			
Germany	1	5,500	5.5	1	5,500	5.5
Czechoslovakia	1	168	0.2			
Hungary	1	163	0.2	1	163	0.2
Other countries						
	365	$3,485,606	9.6	170	$1,875,887	11.0

*Subject to revision as 1928 figures are preliminary to final compilation.

FIG. 2—U. S. AIRPLANE EXPORTS

Country of Destination	Estimated 1929: No.	Value	Average Value in 1,000 s of Dollars	Estimated 1930: No.	Value	Average Value in 1,000 s of Dollars
Canada	200	$2,000,000	10	300	$2,500,000	8
Peru	40	400,000	10	50	450,000	9
Argentina	40	400,000	10	60	540,000	9
Mexico	90	900,000	10	100	900,000	9
Brazil	40	400,000	10	50	450,000	9
Cuba	20	200,000	10	30	270,000	9
Australia	50	600,000	12	100	1,000,000	10
Philippine Islands	20	300,000	15	20	200,000	10
United Kingdom	10	100,000	10	10	100,000	10
China	75	750,000	10	100	800,000	8
Chile	50	1,250,000	25	20	400,000	20
Colombia	10	200,000	20	10	150,000	15
Japan	40	800,000	20	60	900,000	15
Belgium	5	30,000	6	10	50,000	5
Siam	25	500,000	20	30	450,000	15
Nicaragua				20	200,000	10
Honduras	10	80,000	8	10	70,000	7
Netherlands	5	25,000	5	8	32,000	4
Salvador	5	75,000	15	10	100,000	10
Italy	5	30,000	6	5	25,000	5
Bermuda						
Austria	5	50,000	10	5	45,000	9
Neth. E. Indies	5	75,000	15	10	100,000	10
French Oceania						
Venezuela	10	200,000	20	15	135,000	9
Germany						
Czechoslovakia						
Hungary						
Other countries†	40	400,000	10	77	693,000	9
	800	$9,665,000	11	1,000	$10,560,000	10

†Russia, New Zealand, etc.

In the estimates for 1929 and 1930 (Fig. 2) it was considered that several important manufacturers have established plants there which will mean that unit shipments of airplanes will not be shown as such in official statistics, but will be included under the classification of "airplane parts." The 15 flying clubs in Canada are now being equipped with British planes. It is reasonable to suppose that when some of our light and inexpensive training planes, with new production engines, have the "bugs" taken out of them, that they will be sold for club use in Canada. For this reason the unit value estimate for 1930 is shown to decline in the case of Canada.

Peru is a country which although undergoing difficulties from an economic standpoint could use air transportation as a means toward economic recovery. The present aviation operations in the country and the advent of the international airline from the United States indicate that the sales forecast for this country is conservative. Because of the difficult flying conditions in Peru sales of low priced planes should be in the minority.

THE NEXT country listed did not present a very large market during 1928, but 1929 starts off well with the sale of one American plane to the Argentine, valued at $50,000. The few sales made there last year point to an opportunity for considerable expansion as there is a wealthy class which has signified its interest in aviation and is waiting to be sold further on the idea. There have been no American commercial airplanes demonstrated in this market.

Mexico is another country suffering from economic instability, and there is every reason to believe that a few more air services would help it out of its present trouble. There are several lines now in opration, all of which use American equipment. It is expected that early this year the Government will have concluded the purchase of some American military aircraft. Some of the estimated exports will undoubtedly be to the American operating company, but they nevertheless will be sales of aircraft for use in Mexico which will contribute to the prosperity of the country and to the coffers of our airplane factories.

There is now some important business pending in Brazil for training planes and aircraft for transport purposes. It is thought that the first manufacturer to demonstrate planes of these types in that country will find the effort worthwhile, if not from the immediate orders from the standpoint of having made a start in the market. It will be noted that the estimated average valuations for most countries show a decrease for 1930 under those for 1929. Brazil, as well as some of the other countries, may be considered something of a price market. Furthermore, by 1930 it is thought that in-

Under this heavy pressure of activity, the Department has never caught up. The various divisions and sections are still trying to find "short cuts" to eliminate delay and get planes and men into the air—and to keep them there This has been the watchword of the Aeronautics Branch since its beginning It has never been a red-tape office, in the accepted sense.

But the number of planes, pilots, mechanics and students has been and continues to be one big jump ahead Naturally, there have been regrettable instances of lost business in the industry, embarrassing to manufacturers, operators, pilots, schools, and students, simply because the Department has not had enough personnel—both field and office—to keep abreast of the swift current.

Nor could it "alibi" out of its difficulties, and broadcast this condition to the industry That is, no one on the "inside" could do so, and no one on the outside appreciated the unfortunate situation.

In the past two years some chronic "kickers" and some men with legitimate complaints have criticized the Department bitterly, especially the Regulation Division, with its licensing, inspection, and engineering sections

Those who complained very nearly had a chance to be free from the "intolerable burden,"—and the danger is not permanently past

Here is what happened

The Budget Bureau, accustomed to large demands and strenuous outcries by Government departments, and quite accustomed to cutting these demands and turning a deaf ear—failed to see any necessity for a certain item in the appropriation bill for the Aeronautics Branch "Traveling expenses for inspectors." This item was to cover the expenses of inspectors in making their regular rounds through their districts The Department had found that regular itineraries, published throughout the districts, permitted more pilots and owners to to be at specified places on certain dates and be examined, or have their planes inspected Only by these regular trips, completed once a quarter and begun again at once, could licensing and inspection remain even its "one step behind."

"But," said the Budget Bureau—in effect, "let the inspectors stay 'put.' There's no need of their running around all the time Let the pilots come to them at one established base"

This may not at first glance seem serious But it reduces to this:

The Department could not reasonably compel an applicant to leave his place of business at a time it specified, fly his plane a long distance, and await, perhaps several days "in line," for an examination. If it did it would tie up hundreds of planes, hold pilots on the ground, cause a hopeless jam at the inspector's post, and anger the industry It would have to "request" applicants to present themselves at a certain date, or "such a time as convenient," meanwhile giving letters of authority as was first done in regulation work. These letters of authority would run on and on, with renewals, until the applicant found it "convenient" to come for his examination Any reasonable excuse would have to be accepted

Hardly any comment on this is needed. Even the best intentioned pilots would wait their own pleasure to "drop in and see the inspector." Those who had any doubt about their ability would be strangely busy at some other part of the district. Months would pass before they appeared, if at all. And even strict letters, ordering them to appear, would not help much, unless an inspector had authority to go out and look them up

The same applies to airplanes When and if the owners cared to fly their planes to the inspector they would be inspected, not otherwise All the time, letters of authority would flourish abundantly, the mischief makers of the industry would laugh long and merrily at the Department of Commerce

Until—capital withdrew!

For withdraw it would, unless the industry got busy at once and set up its own standards, or carried out the Department's system. That is hard to expect of any industry, especially one growing so rapidly as aviation And it would take time During the period of change there would be chaos

The insurance companies would be the first to close their doors to aviation Standards would be too uncertain for writing big policies They would not take the word of operators, unsupported by other opinion, official in nature. Rates would soar, high as those of 1924 and 1925, perhaps higher. Finance companies would cross off airplanes selling from their books, until the riot was over Operators would again have trouble in getting good steady pilots—and making them stay that way. And in the piloting game there would be one grand free-for-all A student could run wild, taking passengers where he pleased, as long as he stayed a short distance from the inspector

To be sure that this opinion would not be too far-fetched, I asked the question first mentioned in this article of Maj Clarence M Young, director of Aeronautics, Department of Commerce

"If regulation were to cease for six months, we'd be worse off than before we started," he told me "It would be chaos of the worst kind And it would take twice as long to get even with where we are now. And we aren't caught up yet"

This is no cry of "Wolf." Nor is it any severe criticism of the Budget Bureau, for naturally those not close to the industry cannot begin to appreciate what a disaster this step would be Yet the outlook is none too bright, for this is a period of utmost public confidence in flying The business is popular And if the picture is not clear today to those who can so easily nullify regulation, it may be less clear tomorrow.

The Department of Commerce can do no more than it has done Desperately, with strong loyalty to the industry, it has tried to point out what would happen under such circumstances But the Budget Bureau is used to strong pleas, and probably it is accustomed to suspecting personal desires to build up departments The Department should have the hearty support and cooperation of the industry in this matter The industry has been too busy in the "gold rush" to learn these problems It has been glad to receive what help it could from the Department When it has been held up for any reason it has complained—naturally But a little study of the situation, and understanding of support in the request for more field and office personnel would result in elimination of the trouble—and result in direct benefit to those governed by the Air Commerce Act

This is the first of a series of six articles prepared by Mr Keyhoe and dealing with the Aeronautics Branch Department of Commerce. The second article will appear in an early issue—Ed

The TREND in AIRPLANE *Body Design*

By H. C. Wendt
Body Engineer, Fairchild Airplane Mfg Corp

Any well-informed automobile salesman will tell you that the purchasing of an automobile is usually a family affair For this reason, he will also tell you, 90 per cent of automobile sales are made through women

He will tell you that most women have little regard for mechanical excellence, performance or speed, but base their judgment mainly upon appearance and comfort What is under the hood and in the chassis is not well understood by them and is a matter of minor concern Being eye witnesses to the fact that all makes of cars seem to carry their passengers from point to point without noticeable effort, they are contented to let the matter remain there and take performance and mechanical perfection for granted Let the exterior present a study in graceful, well-proportioned design, however, let the paint combination be particularly pleasing and the interior a combination of luxurious upholstery and rich appointments, and the decision is made and the car as good as sold

An interior view of the cabin of a Fairchild "71" showing the heater safety belts and automobile hardware

The influence this attitude has had upon the automobile industry cannot be estimated We do know that if automobiles had remained in the form in which they were 10 or 15 yr ago, we should never have seen the automobile industry as we know it today, regardless of the degree of mechanical perfection attained We also know that if the radio had not discarded its ugly panel covered with dials and switches, if the phonograph had not concealed its mechanism and clumsy horn; and if both had not become articles of furniture which harmonize in the most fastidiously furnished home, these would not have won the complete public acceptance they enjoy today. This trend toward refinement of the product is almost universal Even such work-a-day articles as the electric washer, vacuum cleaner, typewriter, kitchen stove and what-not have come under this influence

Now that women have started the reform, the men are wholeheartedly helping the thing along and will eventually take the entire credit to themselves Without taking the time to prove it, we can safely state that the mechanical male mind leans primarily toward utility while the feminine mind takes pleasure and comfort and has more trust in a product that looks the part What can we in the airplane industry learn from this? Certainly it will have no influence upon the types of planes which carry our mails, express and freight Neither will it affect those planes which are used for combat purposes by the Army and Navy, nor highly specialized types used for endurance flights, exploring, crop dusting, photography, mapping and the like But we cannot be content with any such limited usage as this We cannot be content with anything short of complete public acceptance This means that families and individuals must make the same use of airplanes as they now make of automobiles, trains, subways, steamers and other means of transportation, and do it just as nonchalantly We know that day is coming, inevitably it must But how can we accelerate its arrival? Simply by instilling

confidence in our product into the public, now more receptive than ever before.

I know of one transport company which lost five passengers on a 400 mile trip just because one member of the family had lost confidence in the equipment. One look at the planes this company used, just a week before the family vacation began, settled the question. The entire family started its vacation with a train ride.

Last summer I spent many of my leisure hours at various flying fields and at times was privileged to have a close-up view of the public's attitude on flying. I remember one young lady who refused her escort's offer of a hop with the remark "No, I'm afraid. That plane looks like a starved horse with its ribs sticking out!" Another declined with "The black thing looks like a big coffin." These are not isolated cases. I could quote many others from my own and others' experience. Some one says that women are finicky. That remark however, is not an answer nor a solution.

Another view of the Fairchild "71" cabin interior. This photograph was taken from the pilot's seat looking back

The reason that eye appeal is such a great factor with this sex is not a great mystery. I believe that centuries of training along non-mechanical lines has forced this trait upon women. Nor is it entirely confined to women. Anyone who does not understand the manner of operation of a machine must necessarily let his judgment be based upon the evidence of his senses. A very small proportion of the present day public understands the theory of flight or the operation of aircraft therefore eye appeal cannot help but be of the greatest influence in establishing confidence.

The airplane, naturally has very little exterior resemblance to any other means of transportation. Instead of fostering that dissimilarity we should do all in our power to lessen the difference in appearance. As the automobile is far more familiar than any other means of travel, it should serve as our starting point in exterior design. As soon as our planes strike a few notes in common with those of the automobile they will also strike familiar chords in the minds of the public. The gap between "motor consciousness" and "air-mindedness" will be bridged by easy stages if every surrounding is made reminiscent of the most familiar things.

Possibly the easiest step in this direction that can be made is in the paint scheme. In no other branch of transportation, in fact in no other product offered to the public, have we seen such wild and impossible combinations of color as we have on the average airplane today. Visibility, of course, is a factor but I do not believe that the horrible yellows and oranges which we have used in the past on wings and fuselages are necessary. Why not use a color which will be visible enough and still neutral to any other color which might be used to decorate the plane? I believe this requirement is nicely met with a fairly deep shade of cream. This color is highly visible and yet blends nicely with reds, maroons, and practically every shade of green and blue. Having painted the wings and possibly the tail surfaces in this shade of cream, let us decorate the fuselage in two contrasting shades of blue, or green, or in a deep maroon and a lighter red, taking care always to keep the darker color above the lighter color, as this reduces the apparent height of any object and accentuates its length. Let our colors be bright if they must, but let us not violate conventions and good taste by piling on layers of blue, orange and scarlet with absolute disregard to every law of color harmony.

Consider doors and windows for a moment. Doors certainly must be wide and high enough to permit of easy entrance and exit. Great thought must be given in advance to the fuselage structure, in order that this requirement may be met and that no tubes cut off the corners of the doors, thus producing unsymmetrical shape and inconvenience to passengers. Before any tubular or other structure is definitely decided upon, every effort must be made to arrange the structure in such a manner as to eliminate unnecessarily wide gaps between windows and to guard against any of the construction's showing in the window opening.

Few persons have any idea of the load which may be safely imposed upon a tube. When a tube is exposed, their thoughts run to the apparent flimsiness of the structure and their confidence in it is destroyed.

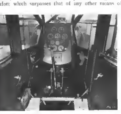
In the design of an automobile, window form and arrangement is considered one of the most important details. The same must be made true of an airplane if we are to reach a similar state of perfection. Windows should be long and narrow in order to accentuate the apparent length of the cabin and reduce the apparent overall height of the fuselage. Freak shapes which do not blend in with the rest of the design must be eliminated. Each window should be framed with beautifully finished sheet metal as is the automobile's. Nor is it sufficient to make this a flat piece of metal resting flush against the window. The windows should be set in at least a short distance and the metal flanged in to meet it, in order to give the appearance of solidity and to eliminate the "tinny" appearance which a raw edge of sheet metal always gives. A fairly wide moulding just below the windows and running the full length of the fuselage, outside, this moulding actually existing and not merely painted on, will again add to the apparent

slender length and will form a logical breaking point for the two shades of color used on the fuselage.

Another word about doors. Psychologically a door one-half inch or an inch thick is very bad. Frequently people wrongly consider the door as the only thing between them and a drop of some thousand feet. A light but thick and husky looking door will give an added feeling of security far out of proportion to its cost and slight extra weight.

Having enriched and harmonized the outside appearance of the plane, and thereby having provided the public with an easy mental stepping-stone to a comparatively new type of transportation, we turn our attention to the interior. Here, indeed, we have an opportunity to do wonders.

To begin with, we find that the average plane, particularly the cabin plane, is entirely too narrow for two persons to sit in side by side in comfort. Before the public will generally accept the airplane as a means of common transportation, fuselages must be widened so that the seating comfort is even greater than it is in the automobile. Nothing is more uncomfortable than a long trip in close quarters. Passengers put up with such a thing on a short hop taken just for the thrill, but the airplane industry cannot exist on the basis of selling but one ride to a person. We must sell the public on the idea of using the airplane to go anywhere, regardless of distance, and to do so we must provide a degree of comfort which surpasses that of any other means of



The instrument board and the controls of the new Fairchild "71" cabin monoplane

transportation. The upholstery must be not only comfortable but luxurious. Passengers must be able to lounge at ease, move about when necessary or desirable, read, converse, doze off, or watch the countryside slip by. Everything in the cabin must convey a feeling of ease and comfort. The floor must be covered with a rich carpet, the cushions with excellent broadcloth, mohair, leather or any of the better types of materials found in the finer motor cars. Door handles, window-lift handles and other hardware must be rich in appearance; smoking sets, arm slings and the other refining details of the finest cars must be included. All tubular and other structure must be out of sight, the windows finished with walnut or mahogany mouldings, the doors weather stripped to eliminate draughts, and the windows installed in such manner as to be easily adjustable for ventilation and yet absolutely weather-tight in cold or storm. Other refining details such as broadlaces, raised welts, seaming cords and pasting laces should be used to give the impression of infinite and minute attention to detail.

A great amount of study and work must be done to eliminate the various and numerous sources of noise in the interiors of cabin planes. Engines must be silenced so that conversation can be carried on without strain; the greatest discomfort experienced in air travel is the terrific din which assails the ears at all times. The public will not tolerate this very long, and unless every effort is bent towards eliminating this unpleasantness we will find it very difficult to interest the passenger in a second ride. The use of silencers on engine exhausts, and the use of sound absorbing, and sound reflecting materials around the entire cabin have proved effective; under no circumstances can the use of such materials in liberal quantities be dispensed with in passenger planes.

Of course I have heard many arguments against any procedure as I have outlined above. One argument is that it adds weight; added weight makes for decreased performance, which again means fewer rather than more sales of such a refined plane because in the final analysis the pilot buys the plane and bases his entire judgment upon air performance. It is true that to a great extent the report of a pilot has a heavy bearing in the purchase of a plane, but I risk condemnation of every pilot in the country by saying that it should not.

No doubt a good pilot is in better position to pass upon the mechanical excellence of aircraft than, let us say, the executives of a transport company in the market for planes to be used in passenger service over an air route. But the features which sell it to the pilot are not the same features which sell it to the public. What if a good wide cabin does decrease the speed of the plane a few miles an hour compared to one with a narrow, cramped cabin? Will such a consideration influence a passenger about to embark on a four or five-hour journey? Never in the world!

I realize that a certain proportion of the novelty-seeking thrill-hungry public will fly in a plane regardless of its appearance, refinement and comfort. While this patronage is more than welcome, we cannot cater primarily to it without falling short of the complete public acceptance which we must have. It is certain that the safe and sane, conservative type of citizen will not purchase an airplane for personal use unless it compares favorably in appearance with an automobile of comparable price; mechanical excellence, of course, being taken for granted. Nor will these good folk use air transport in preference to other means of transportation unless we give them the same degree of comfort plus greater speed, than they can get in any other sort of conveyance.

Some men in the airplane industry agree that the necessity for refinement and beautification is true in principle, but say that the time is not yet ripe for it, and such treatment must be reserved for the future.

I cannot agree with that statement. The airplane has proved its utility. Famous flights have put the public in a receptive mood towards aviation and public interest is aroused. Let us make these improvements now, before the public comes to the conclusion that the old, comfortable, slower means of transport are preferable, after all.

More Than 108,000 at Second All-American Aircraft Display

Estimate About 500 Craft Bought During the Show

CONVENTION HALL, DETROIT (MICH.)—Though it was thought attendance figures would fall well below those of last year, Detroit's Second All-American Aircraft Show closed on the eighth day with a total of 108,000 paid admissions, not including several thousand reported from blocks of tickets delivered to various organizations. This brought the attendance of the second show approximately to that of last year, which, according to Ray Cooper, exposition manager, drew 110,000 persons. The exposition last year was seven rather than eight days in length.

As nearly as could be ascertained, airplanes sold or contracted for by distributors during the show totalled about 500 in number representing a value of approximately $3,500,000. Outstanding among these orders were those placed for 87 Cessna craft and for 105 Great Lakes 2T-1 planes. The Cessnas, to cost $780,000, were ordered by the Curtiss Flying Service, Cessna representative, while the Great Lakes trainers were contracted for by Maj. P. G. Kemp, former Universal Aviation Corporation vice president, who will act as distributor. The cost of the Great Lakes planes was put at $700,000.

Noted among the other orders was one for 25 Arrow Sport planes for the Flo Flying Service, Ann Arbor, Mich., an order for 20 of the new Model 32 Alexander Bullets for the Aero Corporation of California, and a contract for five more 32 passenger Fokker DT 32's by the Universal system, bringing this firm's order to 10.

Other Sales Reported

Fifteen Alexander Bullets were ordered by James S. Charles, of Richmond, Va., while six were contracted for by Willis Kysor, Niles, Mich., operator; five Parks P-1 open biplanes will go to T. M. Miller; five Fairchilds were ordered by the Braniff firm in the South; and three Kreutzer tri-engine planes were called for by the Aero Accessories Company, Chicago. Various single sales furthermore, were reported by numerous manufacturers, among these being the Stinson, Fairchild, Moth, Verville, Travel Air, and New Standard companies.

Among engines orders was a contract by Command Aire, Inc., for a number of Siemens-Halske power plants; while Issotta-Fraschini reported sale of a six cylinder engine to Grover Loening. Through George B. Post, the Edo Aircraft Company announced the sale of 13 sets of Edo pontoons. Sale of a welding outfit to the Stinson firm was reported by the Linde Air Products Company, which announced it would supply the aircraft manufacturer with complete oxy-acetylene apparatus for the new Wayne, Mich., factory.

W. J. Savage Company, Inc., Knoxville, Tenn., stated it had sold two of the gray metal cutters displayed at the show to the American Aeronautical Corporation, New York. Many pending contracts were reported by the Savage firm as a result of the showing at Detroit.

Five Recommended For Aero Secretary

WASHINGTON (D. C.)—Among those men whom either their senators or men of the aeronautical industry have recommended to President Hoover as successor to William P. MacCracken, Jr., assistant secretary of commerce for aeronautics, are the following: Porter Adams, former president and now chairman of the executive committee of the N.A.A.; Clarence M. Young, director of the Aeronautics Branch, Department of Commerce; Maj. Talbot O. Freeman of Connecticut, who was with the American Naval Unit in Italy; John Voorhies, Columbus, Ohio, former member of the Ohio legislature and former member of the Yale Naval Aviation Reserve Unit; and Edward P. Warner, former assistant secretary of the Navy for aeronautics. Assistant Secretary William P. MacCracken is tentatively scheduled to leave his position about June 1, it is understood.

Wright Aero Gets Assembly Plant

ST. LOUIS (MO.) — The Wright Aeronautical Corp. has leased a three-story factory building at the southeast corner of McKissock and Adelaide avenues here as an assembly plant for Gypsy engines and work of equipping the plant will be started immediately under W. K. Swigert. The plant will employ 200 mechanics and will produce several hundred engines a month.

Seek Florida Plant Sites

ST. PETERSBURG (FLA.)—The Travel Air firm of Wichita, Kan., and A. V. Trotter, of San Diego Calif., are each reported to be considering the establishment of an airplane factory here.

S.A.E. Holds Two-Day Program

DETROIT (MICH.)—A series of interesting sessions constituted the two-day program provided by the aeronautic section of the Society of Automotive Engineers during the week of the recent All American Aircraft Show.

The program began Tuesday morning with a visit to the Ford Airport where experiments in towing gliders by automobile were conducted. The technical sessions of the first national aeronautic meeting began Tuesday evening with a dinner at the Book-Cadillac Hotel. At the dinner the Wright Brothers Medal was awarded to Lieut. Comd. Clinton H. Havill. E. P. Warner was toastmaster and Brig. Gen. W. E. Gilmore was the speaker of the evening.

On Wednesday morning a meeting of the standardization committee of the airplane engine and design divisions was held. The afternoon session consisted of a paper on the magneto compass by F. P. Wills, of the General Electric Co., followed by a discussion by Charles Colvin of the Pioneer Instrument Company.

At a joint session with the National Gliding Association, Miss Amelia Earhart and Reed Landis discussed gliding from the enthusiasts' standpoint. Later Dr. Wolfgang Klemperer was introduced by Anthony H. G. Fokker and Dr. Klemperer read an interesting paper on gliding, in which he pointed out that consideration of engineless craft involved a consideration of pure aerodynamics.

Two papers were read at the evening session, the first by Dr. G. W. Lewis, of the N.A.C.A. and the second by Lieut. C. B. Harper, of the Bureau of Aeronautics. Dr. Lewis' subject was the N.A.C.A. engine cowling and Lieutenant Harper discussed wing slots and their application. Both papers were illustrated by lantern slides and interesting discussion followed after each was read and at the end of the session.

National Tour Date Set

DETROIT (MICH.)—The annual National Air Tour is to be held from October 5 to October 21, covering about 3,980 miles, it was announced during the All American Aircraft Show. The planes will start from this city and will visit St. Paul, Des Moines, Ia., Kansas City, Mo., Atlanta, Ga., Baltimore, Md., Philadelphia, New York City, Augusta, Me., Ottawa, Montreal, Toronto, Windsor, Ontario, and return to Detroit. Ray Collins will be manager and Capt. Frank Hawks referee.

Increase "Patrician" Price

BRISTOL (PA.)—The price of the Keystone Aircraft Corporation's 20-passenger Patrician monoplane transport has been increased from $85,000 to $90,000, it has been announced. The change in price became effective April 10. Nearly a dozen of these planes are under construction.

Glider Interests Hold Conference

DETROIT (MICH.)—Opened by Edward S. Evans, founder and president, the National Glider Association held a conference Wednesday during show week, with glider clubs from all parts of the country—nine in number—represented. Not all of these, however, were affiliated with the N.G.A.

The morning was occupied with general discussions and reports. The California Glider Club and the University of Detroit Club, it developed, have been the most active. E. T. Akin, representing the Glider Club of Breckenridge, Tex., reported considerable success in towing experiments.

At a joint session with the S.A.E. in the afternoon, Miss Amelia Earhart and Col. Reed Landis talked on their glider experiences, while Dr. Wolfgang Klemperer, an expert both in theory and practice, gave a most interesting and valuable exposition of the various phases of gliding and soaring. Dr. Klemperer's talk was illustrated with lantern slides. It was followed by moving pictures of gliding both in this country and in Germany which were supplied by the Air Service, by Anthony H. G. Fokker, and by the N.G.A. Later in the week, demonstrations of gliding were given by University of Detroit students.

Clubs and their representatives were as follows: California Glider Club, Charles Ferguson, San Francisco; Glider Club of Breckenridge, Tex., E. T. Akin; Glider Club of Wisconsin, Carl Schoeter, Milwaukee; Cleveland Glider Club, Kenneth Ross; Akron Glider Club, Dr. Wolfgang Klemperer. Michigan was represented by the Dearborn Glider Club, the Albatross Club, and the University of Detroit Club, each of which sent several members. Enthusiasts from Chicago, St. Louis, and New York were also present.

Aircraft Steel Enlarges Plant

WICHITA (KAN.)—The Aircraft Steel Corporation of this city which handles steel for airplane use exclusively, is building an addition to its plant which will more than double its capacity. The addition will accommodate incoming stocks of raw material used in manufacturing the products this company distributes to all parts of the country. Among customers of the Wichita concern are the largest aircraft plants in America. A. E. Martin is president of the company which was organized here less than a year ago, and O. W. Wortman is vice-president.

New Plant for Supreme

WICHITA (KAN.)—The Supreme Propeller Company of Wichita is building a new $35,000 factory to take care of the flood of orders. The new building will be of brick and steel. The output will be boosted from 12 to 50 daily, it is said. A new type of steel propeller is planned.

Russia Orders 'Chutes

BUFFALO (N.Y.)—An order for 300 parachutes has been received for the Russian Government Air Force by the Irving Air Chute Company, Inc., of this city. This order supplements another Russian order for 200 'chutes received a short time ago. Substantial orders have been received recently also from the Governments of Norway, Cuba and Greece. It is reported that the company has orders on hand at the present time exceeding the entire output for 1928.

Problems Discussed By the Manufacturers

DETROIT (MICH.) — On Tuesday morning during exposition week, the public meeting of the Commercial Manufacturers Section of the Aeronautical Chamber of Commerce was held. The representatives of about 40 companies were present, but with a few notable exceptions they were not the men who guided the company policies.

A report was read by Mr. Noorduyn on the work of the standardizations committee, but as the main dealings of this committee is with the S.A.E., the discussion was rather listless. In the absence of Mr. Love, a brief report was read dealing with the work of the flying school committee and with its relations to the Department of Commerce.

Quite a lively discussion was entailed on the question of aircraft firms pirating each other's employees. It was pointed out that in Wichita a gentlemen's agreement obtained that only men out of employment would be hired, and those hired would not be taken at a greater salary than they had been getting.

Buys Pittsburgh Interest

PITTSBURGH (PA.)—A substantial interest in Aircraft and Airways of America, Inc., which is to own and operate the Bettis Field, eight miles south of here, has been bought by the Curtiss-Keys group. The field will be enlarged and used as a unit in the chain of the Curtiss Flying Service, Inc. Aircraft and Airways, Inc., owns Servair, Inc., representative of the Wright Aeronautical Corporation here, and the Reading Airways, Inc., which is to operate passenger service between here and Philadelphia and Washington and New York under the name of Eastern Air Transport.

Brown to Handle Walter Engine

OKLAHOMA CITY (OKLA.)—Willis C. Brown, formerly president of the Spartan Aircraft Company of Tulsa, Okla., has resigned from that position to take charge of a factory branch in Tulsa of the Walter engine, manufactured by J. Walter & Co. of Prague, Czechoslovakia. No appointment to Mr. Brown's position has as yet been made. The Spartan organization will continue to equip its C-3 model with the Walter engine.

Keystone Secures English Plane Rights

Will Build Flying Boats Of Short Brothers' Design

BRISTOL (PA.)—Another famous foreign line of aircraft is to be built in this country by an American company. This time the planes involved are the Short Brothers' products and the American interest is the Keystone Aircraft Corporation of this city. This concern has secured all manufacturing rights in the United States of all commercial designs of the Short Brothers, including floats.

The English firm has been conspicuous in the commercial field for their flying boats, one of which is the Short "Singapore," a three engine, 15-passenger flying boat on which Keystone will specialize. This machine has a speed of 103.8 knots at 5,000 ft. and a service ceiling of 12,650 ft. It is powered with three 525 hp. Bristol Jupiter IX geared air-cooled engines mounted between the wings and driving tractor propellers.

Has Navigation Compartment

Two pilots sit side by side in a cockpit in the nose, complete dual controls being fitted. The second pilot also has duties as navigator and wireless operator, and a compartment back of the cockpit has been fitted out with all necessary equipment for his use. The 15 passengers are seated in rows of three. The seats are metal framed and are fitted with detachable cushions which may be used as life belts in emergency. There is a collapsible table and a porthole for each seat, and adequate cooling, heating, ventilating and lighting are provided.

In the rear of the cabin is a buffet fitted with oil cookers and ice chest and back of the main cabin is a lavatory. Back of this is a baggage compartment. The wireless equipment provides telephone range of 200 to 250 miles and telegraph range of 300 to 400 miles. The span of the top wing is 93 feet. Height of the plane is 22 ft., 3 in., and its length is 64 ft., 9 in.

The Short company is the oldest established firm of airplane designers and producers in the United Kingdom having been founded in 1898 for the manufacture of spherical balloons. Design and manufacture of airplanes was added to the business in 1908. The firm began production of seaplanes in 1911 and in 1913 developed a folding wing device which made it possible for the English Navy to carry seaplanes of large dimensions. The company has been the leading England exponent of metal construction for many years.

Eagle School Moved

DEKALB (ILL.)—Eagle School of Aviation, owned and operated by Dr. Henry J. Neubauer, has been moved from its former location at Hinckley, Ill. to the Dekalb County Airport near Waterman.

Fairchild States Expansion Program

Addresses Detroit Gathering of Agents

DETROIT (MICH.)—An expansion program of wide scope was announced by Sherman M Fairchild, president of Fairchild Aviation Corporation, at a dinner given by the corporation to its distributors and dealers at the Book-Cadillac Hotel, April 10.

A. A. Woodruff, sales manager, outlined the sales and dealers' help policies of the organization, production schedules, deliveries and the advantages of Fairchild models 21, 41 and 71 and the Kreider-Reisner Challenger biplanes which have been added to the Fairchild line

Information conveyed to the dealers indicated that the Fairchild Corporation, by reason of the varied manufacturing and service activities of its subsidiary companies and by its recent affiliation with the Aviation Corporation, now occupies a position of great strength in the industry.

Studying Flying Boats

The Aviation Corporation, which may control 56 per cent of the Fairchild stock, now holds a large interest in Universal Airlines and Colonial airlines

Fairchild Aviation has now acquired the Kreider-Reisner Aircraft Company and is interested in the Pittsburgh Metal Aircraft Corporation, which will produce an all-metal plane.

It was announced, furthermore, that Fairchild was conducting extensive experiments with flying boats and amphibion planes, and will in the near future, announce important developments along that line.

Announcement was also made of the world's largest commercial wind tunnel, designed by Col V. E. Clark, formerly in charge of the Army Air Corps Engineering Division at Dayton, Ohio, which is to be installed at the Farmingdale plant

To Produce 580 Planes

Last year the Fairchild corporation and subsidiaries did a gross business of $2,600,000 This year, including production of Kreider-Reisner planes, Fairchild expects to do a gross business of $10,000 000

The plane production schedule, as announced by Mr Woodruff, was 580 Fairchild planes, which included 300 21's, 100 41's, 180 71's, and 500 Kreider-Reisner planes. As an indication of the present demand, Mr Woodruff stated that bona fide orders, totalling $200,000 had been mailed to the factory April 9, representing business done that day

Co-operation with dealers, Mr Woodruff stated, called for an appropriation of $125 000 for dealers advertising and helps, $40 000 for institutional advertising, and an eight-page house organ folder to be distributed monthly A dealers' bookkeeping system, visits by service representatives, a substantial commission to dealers on aerial survey contracts secured by them, in addition to rental of dealers' planes for the actual survey work, was also announced In addition Fairchild operates a modern training school at Farmingdale and will distribute to dealers all possible training method helps

Model 71 Praised

Deliveries within 60 days were promised for the new model 61 designed as a four-place dual control with 225 hp Whirlwind, or 6 place dual control with 300 hp Whirlwind, with an announced performance equalling the leaders on the market Mr Woodruff stated that Army tests recently completed, revealed the Model 71 as an outstanding performer in its class

In discussing available facilities for the manufacture of the 80 hp Genet engine, it was said that Fairchild has an engine plant equal to any in the country from which some very interesting engine developments may be expected The Genet engine was selected after 200 hr of dynamometer and flight testing of 10 Genet engines, during which time only two minor failures occurred

The assembled dealers were given a very frank statement regarding certain costly manufacturing setbacks experienced by the company recently, namely failure of the Caminez engine to come up to expectations and necessary changes in design of models 41 and 21 due primarily to inability to obtain the engines for which they were designed

Engine Experience Valuable

However the experience gained and the modern engine production tools and complete engine testing equipment installed at Farmingdale, which are now available for production of the Genet engine and for other important engine developments are proving of great value in the present expansion program

The Caminez engine tests resulted in bringing into the Fairchild group the Kreider-Reisner Company, because Mr Woodruff stated the plane produced by this company proved to be capable of withstanding the excessive vibration of the Caminez engine.

Gets Cessna Plant Contract

WICHITA (KAN.)—The W S Henrion Construction Company has been awarded the contract for construction of six new brick and steel factory units of the Cessna Aircraft Company The building project involves $125 000 Plans call for completion by the middle of June It will contain 55,000 sq ft of floor space. The Cessna company plans to turn out between twenty and 25 four and six-place cantilever wing monoplanes weekly after moving into the new plant The payroll will be increased to approximately 200

Aviation Corporation To Absorb Colonial Line

NEW YORK (N. Y.)—Colonial Airways System, which includes Colonial Western, Canadian Colonial, and Colonial Air Transport, is to be absorbed by The Aviation Corporation, it has been reported here. A contract between the two concerns is said to have been executed and completion of the merger hinges only on the acquisition of more than 51 per cent of the Colonial stock

The announcement was made on the eve of the inauguration by Colonial of its twice daily New York-Boston passenger service using three Ford transports. The company operates altogether about twenty planes over 967 miles of airways carrying mail and passengers The lines connect Boston and New York, Boston and Montreal and Albany and Cleveland by way of Buffalo.

Maj Gen John F O'Ryan, head of Colonial will continue as directing head of the system as vice-president of The Aviation Corporation and a member of the board of directors and executive committee The Colonial system is capitalized at $5 000 000 It has been operating between Boston and New York since July 1, 1926

At the same time it was revealed that the Aviation Corporation is planning to take over control of the Embry-Riddle Company of Cincinnati which operates a mail and passenger line between Chicago and Cincinnati by way of Indianapolis This company connects at Chicago with Universal Aviation system and at Cincinnati with Continental Airways, a subsidiary of Universal The Embry-Riddle Aviation Corporation has been formed under a Delaware charter to take over the Cincinnati concern it is said. The Aviation Corporation will share control of this company with Air Investors, Inc, of this city.

Light Lear Plane Tested

WICHITA (KAN.)—Powered with a Henderson four-in-line engine which develops 32 hp, the new Lear long-wing monoplane which is to be manufactured by the Lear Aircraft Company of Wichita, is reported to have passed its tests with flying colors. The small training craft, weighing but 471 lb with engine, developed a speed of 80 m p.h. and landed at the low speed of 20 m p h. Claude Z Lear a student of the University of Wichita, designed the plane

Foulois Shifted

WASHINGTON (D. C.)—Brig-Gen Benjamin D Foulois, assistant to the Chief of the Air Corps and one of the pioneer aviators of the Army, has been assigned to duty at Wright Field, Dayton, O, as chief of the Materiel Division, effective June 30 Brig-Gen William E. Gillmore also assistant to the Chief of the Air Corps, who is now chief of the Materiel Division at Wright Field, has been ordered to rrport to Washington by June 30

AVIATION
April 20, 1929

Nine More Planes One Engine Approved

WASHINGTON (D. C.)—Announcement is made here by the Aeronautics Branch that nine more plane models have been granted approved type certificates, bringing the total certificates awarded to 137 Another engine, furthermore, has received approval, this power plant being the Wright R-540, five cylinder radial air-cooled engine. This plant, which develops 165 hp at 2,000 r p m, was granted approval No. 23

The planes are as follows No. 129—Bellanca CH-300, 6 place cabin land monoplane, Wright R-975-A developing 300 hp, No 130—Travel Air B-6000, 6 place cabin land monoplane Wright R-975-A, No 131—Fleet Model 2, 2 place open land biplane, Kinner K-5, No 132—Stout 4-AT E, 14 place cabin land monoplane, three Wright R-975-A, No 133—Boeing 100, single place open land biplane, Wasp 450 hp; No 134—Bourdon B-2, 3 place open land biplane, Siemens—Halske, SH-14, No 135—Butler "Black Hawk," 3 place open land biplane, Wright R 975-A, No 136—Stinson SM-1F, six place cabin land monoplane, Wright R-975-A, and No 137—Stearman C3MB, single place open land biplane, Wright J-5

Organize Comet Engine Corporation

NEW YORK (N. Y.)—Comet engines, which have been manufactured heretofore by the Aircraft Engine Corporation of California, at Oakland are to be built by the Comet Engine Corporation, recently organized under the laws of Delaware to acquire the entire interests of the other concern Backing the new company are Air Investors, Inc, the Crocker First Company of San Francisco the Gisholt Machine Company of Madison, Wis, and their associates

Harvey L Williams of the executive committee of the Aviation Corporation and president of Air Investors, has been elected president and director John H Geisse, aircraft engineer, is vice-president in charge of engineering George H. Johnson of the Gisholt company, is vice-president also, and a director The other directors include Alan J Lowrey of the Crocker First Company, George Mixter, Stone & Webster, Inc, and Sherman H Fairchild. Manufacture will continue at the present time until a new plant has been built at a site not yet determined

Ford Cuts Prices

DETROIT (MICH.)—Down come the prices for the Ford transports, according to an announcement here. The cuts, ranging from $7,000 to $10,000, mean that the Model 4-AT now may be bought for $42,000, the Model 5-AT for $55,000 and Model 6-AT for $50,000, representing reduction of $7,000, $10,000 and $8 000, respectively

Plan Two New Models of "Bullet"

DETROIT (MICH.)—Announcement by Alexander company officials at the air show indicated that the Colorado Springs firm would bring out two more Bullet plane models designated as the "22" and the "45," calibre numbers being used Production on the Model 32, displayed at the show will begin this month to meet the orders

The Model 22 is to be a two-place craft powered by a small engine of a type yet unannounced The Model 45 will be a four-place plane employing the Wright 300 hp. J-6 plant.

Thompson Gets Big Wright Order

CLEVELAND (OHIO)—A $500,000 order for engine valves, covering the entire requirements of the Wright Aeronautical Corporation, Paterson, N. J, for the balance of the year, has been received by Thompson Products, Inc, this city

According to company officials, this is the largest single valve order ever received by Thompson Products for either automobile or airplane engines, although blanket contracts are in force from large automobile builders, covering several parts, which total more than $500 000

The valves are for five current Wright engine models, using from five to nine cylinders and ranging in horsepower from 150 to 525 The stems of the exhaust valves are hollow to gain light weight—a type perfected by Thompson Products Delivery of the valves will begin in 30 days

Wilcox Concern Builds Plane

TULSA (OKLA.)—Production has been started upon a three-place cabin monoplane of high wing design at the H F Wilcox Aeronautics Corporation's plant west of Tulsa. The plane designed and built by W S Collier, is the third type of plane he has perfected The cockpit is behind the upper wing with a two passenger enclosed cabin directly in front of the cockpit and below the wing

Flying Schools Seek Rating

WASHINGTON (D. C.)—Many flying school operators are reported to have expressed their desire to be placed under the rating system of the Aeronautics Branch which is seeking to establish and maintain certain standards in flying school personnel, operation and equipment

Develops Radio Altitude Indicator

Lights Guide Pilot When Nearing Ground

SCHENECTADY (N. Y.)—Airplane altitudes may be indicated now by an instrument called the radio echo altimeter developed by Dr E. F W Alexanderson, consulting engineer of the General Electric Company The instrument is based on the theory that the time interval required for radio impulses to travel from the plane to the ground and back again to receiving sets on the plane may be adapted as a reliable altitude indicator.

It was discovered that every time the airplane changed altitude by half a wave length a whistling note went through a complete tune cycle from low pitch to a high pitch and back again to a low pitch By counting the cycles of the tone it was possible to measure the altitude, this being registered automatically on a meter on the dashboard graduated up to 3,000 ft The echoes become stronger, of course, as the plane approaches ground A memory meter was developed which displays the last altitude reading until a stronger echo, indicating a lower altitude, occurs

The main feature of this device is its use for landing and in this connection three lights placed on the cockpit panel assist the pilot by visual signals The green light flashing indicates the pilot is 250 ft. above ground The yellow light shows he is 100 ft. above ground and the red light gives a positive warning that the ground is only 50 ft below the plane

If a depth sounding is desired when climbing, in which case the echo is becoming weaker constantly, a push button may be used to eliminate the memory features of the meter and each succeeding reading of the meter then is an indication of the last echo Thus a depth sounding may be taken at any time during the flight whether the plane is ascending or descending The device is said to be still in the experimental stage

Open Welding School

KANSAS CITY (KAN.)—A new kind of aviation school has been opened here by S Q Noel and W D Patterson The school is known as the National Aircraft Welding School Six students were enrolled the first week The students will be trained in welding, working in connection with the making and repairing of airplanes

Low Fuel Use Reported

WICHITA (KAN.)—Only 57 gal of gasoline were consumed in the recent flight of S T Stanton of the Cessna company in a flight from this city to Buffalo, stopping only at St Louis The flight was made in nine hours

Two New Firms Organized in Wichita

Select Factory Site for a Third

WICHITA (KAN)—The past week in Wichita saw the organization of two new aircraft manufacturing concerns, and selection of a factory for a third new company.

A W Mooney, until recently chief engineer and designer for the Eaglerock, and H L Shaffer, Denver investment banker, have selected Wichita as the site for a factory to build a monoplane designed by Mooney The new company will bear his name.

Mr Mooney has designed five airplanes which have been approved by the Department of Commerce He has been honored several times for his aeronautical work. The first plane, he says, will be ready for its air tests within 90 days Both Denver and Wichita capital are behind the new concern

Aircapital Aircraft, Inc., has been formed by a group of Wichita, Minneapolis and St. Paul business men to manufacture in Wichita a new type low wing monoplane which already has undergone extensive air tests here. The plane, designed to sell, fully equipped, for less than $2,750, is the work of W. C. Cumming of Minneapolis The new company is capitalized at $250,000

Directors Named

Directors include E. A. Watkins, president of the Central Air Lines company of Wichita, J H Turner, Travel Air director, H. L. Bridgeman, wartime aviator, who will be general manager, R D W Clapp, banker, C E Parr and H W Strong, manufacturers, and Mr Cumming

Only the one type of plane will be turned out by the new company at this time, it is announced. It has a wing span of 37 ft and a length over all at 23.5 ft. With engine the plane weighs 725 lb and can carry a useful load of 480 lb Its cruising speed is 75 m p h Tests with a 30 hp engine have shown the plane capable of a landing speed of 35 m p h LeBlond 60 power plants will be installed in the new planes

The Yunker Aircraft Corporation, moved to Wichita recently from Dodge City, Kan., has acquired a temporary factory and machinery is being installed A new modern factory is planned for later in the summer, as soon as the concern can acquire an airport site George C Yunker is president of the company

Boeing Installs Wing Plant

CHEYENNE (WYO) — Boeing Air Transport Inc, has decided to establish in Cheyenne, Wyo, an entire wing building division, with Ellery A Bennett and E. T Allen in charge All wings will be shipped to Cheyenne and will be rebuilt entirely

Moon to Build Planes

ST LOUIS (MO)—The Moon Motor Car Company of St Louis is to enter the airplane manufacturing business after consolidating with a western plane manufacturing company. Negotiations for the deal are nearing completion and announcement will be made soon The new airplane engine developed by the Continental Motors Company will be used in this machine, it is expected

Announce Bendix Aviation Corporation

NEW YORK (N Y)—Bendix Aviation Corporation is the name of the new combine of leading manufacturing companies for participation in making aeronautical accessories The group includes the Bendix Brake Company, the Eclipse Machine Company and its subsidiaries, the Delco Aviation Corporation, the assets and business of the Stromberg Carburetor Company of America and its subsidiaries, the Scintilla Magneto Corp, and other companies in the aviation accessory field

The General Motors Corporation will have a minority interest in the new company and will provide important rights in the aviation accessory field and rights in connection with other devices Other important rights will be provided also through the Eclipse Machine Company

Vincent Bendix will be president of the concern The board of directors will include Mr Bendix, C E Wilson, Richard Hoyt, C O Miniger, Clement M Keys, Paul H Davis, W L O'Neill, Frederick B Rentschler Albert Bradley, James C Willson, W. L. McGrath, W J Buettner and Graham B Gros venor

Okay Starts Production

MUSKOGEE (OKLA)—The Okay Aircraft Co. is beginning work on a newly-designed three place low wing cabin, Kinner powered, monoplane here in a temporary factory, formerly the Okay Motor Truck works A ten-place tri-engined transport plane is to be built also Wichita has been settled upon as the distribution point of the planes The board of directors includes C N Martin, president, Earl A Bidwell, vice-president, Dan L Jones, secretary-treasurer, all of Wichita, M O Leach, Augusta, Kan, L G. Richardson, Arkansas City, L W. Duncan, Muskogee; J C C Morse of Hutchinson, Kan, and W P Sullivan, chief engineer

Army Has Blind Flying Class

WASHINGTON (D C)—Blind flying practice is being given a class of Air Corps pilots at Bolling Field, one of the first students being Maj Gen James E. Fechet A canvas canopy designed by Capt. Ira C Eaker, instructor, encloses the cockpit of a Douglas observation plane simulating conditions encountered at night or in fog or storm An emergency pilot occupies another cockpit

College Clubs Meet at Detroit

DETROIT (MICH)—For the purpose of perfecting the machinery of the organization, the second conference of the newly formed Intercollegiate Aeronautical Association was held here last week in conjunction with the Second Annual All-American Aircraft Show Representatives of sixteen college flying clubs attended

The first day was devoted to addresses on various aeronautical subjects by a number of prominent authorities These included one on the co-ordination of intercollegiate flying clubs activities with the private flying committee of the N A A, another on intercollegiate gliding, a third on the operation and financing of a flying club and a fourth on intercollegiate ballooning The business of the first day was concluded with an informal dinner The program for the second day included an address on aviation club activities in Canada and a discussion of a permanent organization for the intercollegiate association

The flying club association was formed for the purpose of organizing the college aeronautical societies and flying clubs at a meeting called by the Yale Aeronautical Society at New Haven, Conn., in October, 1928 At this meeting, eleven universities and colleges were represented and some little progress toward the establishment of the organization was made The name was selected, an executive committee was formed, and the purposes of the association were outlined. The second conference to continue the organization work was sponsored by the University of Detroit Aero Society The clubs represented were Yale, Cornell, Carnegie Tech, New York University, Harvard, Michigan, Ohio State, Illinois, Minnesota, Purdue, Toronto, Akron, South Dakota, Texas Agriculture and Mining, Massachusetts Institute of Technology, and the University of Detroit

Seeks Balloon Record

WASHINGTON (D C)—A world endurance record for balloons is to be sought by the crew of the special Army balloon of 35,000 cu.ft. gas capacity to be manned by Capt William Flood and Lieut U G Ent at the National Elimination Balloon Races, Pittsburgh, May 4 The balloon has been lightened by eliminating the net covering the envelope and holding the basket and substituting rigging bands The 250 lb saved will be utilized for ballast and it is hoped that the craft may remain in the air at least 48 hours to break the present record of 47 hours.

Aero Supply to Expand

COLLEGE POINT (L I)—Stockholders of the Aero Supply Manufacturing Company here have approved its plan to purchase the Standard Automatic Products Company of Corry, Pa, and the National Steel Products Company

BRIEFLY

Purple colored gasoline is to be supplied to all flying fields by the Ethyl Gasoline Corporation, the color being adapted to more easily distinguish it from automobile fuel

Twenty-eight army aircraft, 18 of them coming from Lansing Field, Mich, will be flown to the Annual National Convention of the Reserve Officers' Association at Indianapolis, April 24 Several aircraft firms are expected to have exhibits at the airport during the Convention

Three more Vought Corsairs recently took off from Mitchell Field, L. I, with Mexican federal pilots, for delivery to the Mexican Government.

A total of 163 students is reported enrolled in the Porterfield Flying School, Inc., Fairfax Airport, Kansas City

North American Aviation, Inc, reports net income of $500,642 for the first quarter of 1929 Surplus as of March 31 was put at $509,500, with total assets of $25,561,402, of which $7.230.129 is credited to open market securities

New Yorkers have been told that the Slate, all-metal, steam-driven dirigible being completed at Glendale, Calif, is due to arrive in the East in June.

American Cirrus Engine Company of Belleville, Pa, reports a $3,000.000 order of its engine from the Great Lakes Aircraft Corporation

Noel Wein and other pilots in Alaska are attempting to ferry cargoes of fur by plane from the trading posts to transportation centers Success would mean accomplishing in a few days' travel by air what by ground would take several weeks

Mrs Keith Miller and Capt W M Lancaster are planning a transcontinental flight from Los Angeles to New York, either non stop or with but one stop in a tri-engine plane now being built at Los Angeles

Examinations for appointment as second lieutenants in the Army Air Corps will be held in June and October of this year and next year About 65 second lieutenants may be accepted in the first examination and about 58 on the second.

Production of a four-place cabin monoplane is planned by the Courier Aircraft Company, which has leased a factory formerly occupied by the International Aircraft Corporation at North Long Beach, Calif

Arranged by E P Chalfant, executive vice-president, a meeting of the aeronautical committee, National Standard Parts Association, was held in a Lockheed Vega in flight over Detroit during show week William S Brock piloted the craft

Twenty-nine Wasp engines have been ordered from the Pratt & Whitney Aircraft Company, Hartford, Conn, by the Stout Metal Airplane Division of the Ford Motor Company

The General Surveyor, twin-engined cabin monoplane developed by the General Airplanes Corporation, Buffalo, N Y, is being given additional tests at that city's municipal airport Though the plane is now powered by J-5 engines, the J 6 type will be employed when received from the Wright company.

An engine overhauling department has been installed at St Louis by the Robertson Division of Universal Aviation Corporation

A flight around the world is being planned by Capt. Jean F DeVillard, with Peoria, Ill, as the starting point. National Airways System, Inc, now building a factory in that city, is to construct the tri-engined machine which the Captain intends to use

Boeing Airplane Company's engineering staff has been increased to 82 men, almost all of whom are graduate engineers

Detroit Aviation Syndicate, to be capitalized between $5,000,000 and $10,000 000, has been organized to offer financial assistance to aeronautical interests desiring to locate in that city Edward S Evans is the head of the group

The new Waco powered with the Wright R-540, five-cylinder, radial, air-cooled engine, will be designated as the Waco "165" rather than the Waco "150," since the engine has been approved by the Aeronautics Branch at 165 hp

Colonial Air Transport opened its twice daily passenger service between New York and Boston, April 15

Continental Motors Corporation announces it will start quantity production of its aircraft engines about June 1, the first type being a seven cylinder, air cooled radial.

A Neon wind indicator 13 ft long and 9 ft wide, has been ordered for the Albany, N Y., airport

Utica Flying Service, Inc, Utica, N Y, has been recapitalized recently and plans to inaugurate a passenger service to Adirondack resorts this summer

Graham Flying Service of Oklahoma City, is to operate a flying school at Enid, Okla., the fourth in its chain

There is still much for American air interests to learn from Europe, according to Maj Clarence M Young who returned early this month from a survey of operations there

A macadam boulevard which would cut six miles from the distance between St Louis and Lambert Field has been proposed.

Marysville Kan., boasts of an air sign with letters 35 ft high painted in white on a black background the panel of the sign measuring 580 ft x 75 ft The community is also planning to construct an airport

TRADE TIPS

It has ben reported that

Construction of a new school building for the local branch of Universal Aviation schools will be undertaken at Wold-Chamberlain Field in the near future, V L Jones principal, announces

A hangar to accommodate eight planes will be constructed by National Parks Airways, Inc, of which Alfred Frank is president, at the Butte, Mont., field

Erection of a 29 plane hangar is planned by Albert E Beesmer, president of Beesmer Aircraft, Freemont, Neb

A site has been selected near Lakeview on the Pacific Highway, Tacoma, Wash., by the commissioners of Pierce County, for a county airport W E Berry is county engineer

Erection of two hangars at Fairfax Airport, Kansas City, Kan., is being planned by Universal Aviation Corporation of St Louis, Mo, according to announcements

AERONAUTICAL CALENDAR

May 1-3	Joint meeting professional divisions, American Society Mechanical Engineers Detroit Mich
May 4	National Elimination Balloon Race for the Litchfield Trophy, Pittsburgh Pa
May 4-11	Second Annual Montreal Aircraft Exhibition, Montreal, Canada
May 7	International Aeronautic Conference and Exhibition Seville Spain
May 14	Fourth Annual Aircraft Engineering Research Conference, Langley Field, Hampton, Va
May 15 25	First International Congress on Sanitary Aviation Paris, France
May 16-18	Cleveland Airport Convention, Hotel Cleveland Cleveland Ohio, under auspices of the Aeronautical Chamber of Commerce
May 18	Curtiss Marine Trophy Race, Potomac River, Anacostia D C, under auspices of the Aero Club of Washington, N.A.A.
May 23-June 1	First Annual Newark Air Show State Armory Newark N J
May 25-June 1	First Annual St. Louis Aircraft Show New Coliseum, St Louis, auspices Jackson Johnson Post No 72, American Legion, Headquarters Hotel Chase
May 27 30	American Society of Mechanical Engineers, National Aeronautic Meeting Hotel Jefferson St. Louis
May 27-June 2	Indianapolis Aviation Show of the Indianapolis Aircraft Association, State Fair Grounds
May 28-30	Gardner Annual Trophy Race, St. Louis Mo.
June 10-14	First Michigan Air Tour Starting at Pontiac Municipal Airport.
June 27 30	International Light Plane Meet, Amsterdam Holland
July 16-27	International Aircraft Exhibition of the Society of British Aircraft Constructors, Olympia, London.
Aug 24-Sept. 2	National Air Races and Aeronautical Show, Cleveland, O
Aug 26-28	Society of Automotive Engineers Cleveland Aeronautic Meeting.
Sept 6-7	Schneider Cup Race, over the Solent, Cowes England
Sept. 7 15	International Aircraft Exhibit of 1929 Coliseum Chicago Ill
Sept. 28	Gordon Bennett Balloon Trophy Race St. Louis, Mo
Oct. 12-27	Southwestern Aircraft Exposition, State Fair Grounds, Dallas Tex.
Dec 1-9	International Aeronautical Exposition of the Aeronautical Chamber of Commerce Chicago

PERSONNEL

JOHN D MACGREGOR, who as vice-president of Pan American Airways had charge of negotiations with governments in Central America, has resigned to accept a vice-presidency in the Pan American-Grace Company. He will direct preparations in South America for inauguration of a tri-weekly service between the Canal Zone and Mollendo, Peru

CAPT RONALD SMITH has been appointed chief test pilot of the Moth Aircraft Company, Lowell, Mass.

PAUL E. REDDER has been transferred from the Canadian Colonial Airways service to the new passenger line of the Colonial Air Transport between New York and Boston

FRANK P LITTLE of Colonial Western Airways has been placed in charge of the Colonial System flying school at Buffalo

RUSSELL AHRENS and K. K. KNICKERBOCKER have been appointed Boeing traffic representatives at Oakland and Portland, respectively

A J KINSMAN, formerly in the passenger traffic department of the Northern Pacific Railway, has been appointed Passenger Traffic Agent for the Boeing and Pacific Air Transport concerns with headquarters at Salt Lake City

A. B HARRIS has been appointed sales manager of the Kreider-Reisner Aircraft Corporation

CLINTON HEILIGENSTEIN, of Freeburg, Ill, has been selected as instructor at a Greenville, S C, flying school

LIEUT ROBERT L. BROOKINGS has been appointed sales representative of the Curtiss Aeroplane & Motor Company at Buffalo, N Y.

HENRY A. FRAASA has resigned from the Aeronautics Branch to handle production at the Swift Aircraft factory, Wichita, Kan.

CHARLES F WEST, chief pilot and general manager of the Pioneer Flying School, Inc, of Arcola, N J, has been appointed service manager for the Gates Flying Service at Holmes Airport, following the purchase of his company by Ivan R. Gates, president and general manager of the Gates Flying Service, Inc.

B H GILPIN of Syracuse, N Y, has been appointed service manager of the Pratt & Whitney Aircraft Company, Hartford, Conn.

DAVID S. INGALLS, Assistant Secretary of the Navy for Aeronautics, has been appointed to the Advisory Board of the National Aeronautic Association, succeeding EDWARD D WARNER, former Secretary of the Navy for Aeronautics

LIEUT ROBERT A. NAGLE, of the Massachusetts National Guard Squadron, has been appointed test pilot and demonstration salesman for the Bellanca Aircraft Corporation, New Castle, Del

EARL F VASKEY, formerly of the Mahoney-Ryan Company, has become sales manager and advisor of the new aviation department, of the L. E. Gale company, Hankow and Shainghai, China.

J. O. DOCKERY, WAYNE LANSING, CHESTER R. BAILES, ALLEN OLSEN and STANLEY HOLSINGER have been added to the piloting staff of Braniff Air Lines

O F HUNT has been named division traffic manager for Interstate Air Lines at Terre Haute, Ind

RAY KAUFMAN, president of the Accurate Gear Company, Springfield, O, has been appointed to the merchandising and standardization committee of the National Standard Parts Association

JOHN KIEFER, 18 years old, of Kansas City, Mo, has been appointed assistant chief pilot at the Bennett Flying School

MAURICE MARRS and B B DENKE have joined Southwest Air Fast Express as pilots

FLOYD H. MUNCIE, formerly of Ozark Airways, has joined the staff of the McIntyre organization of Tulsa, Okla.

JACK WALTON has been named sales manager of the Yellow Cab Airways Inc, of Des Moines, Ia.

WILLIAM MCFAIL, one of the oldest pilots in point of service on the Universal's Twin Cities Chicago line, has been made assistant manager of operations

JOE GOODALL has resigned from Air Service, Inc., of Minneapolis to join the Thompson Aeronautical Corporation at Flint, Mich

NEIL BRADLEY, assistant sales manager, has been transferred from the Minneapolis branch of Universal's aviation schools to St Paul as manager. He is succeeded at Minneapolis by G. M Graham

Swift Adding Buildings

WICHITA (KAN)—The Swift Aircraft Company of this city, which plans to go into commercial production with three types of biplanes very soon has started work on new factory units The present Swift plant adjoins the new 640-acre Municipal Airport. The present brick and steel building, 50 x 150 ft., will become the metal working shops of the factory. A 50 x 50 ft. addition and a dope house, 50 x 80 ft, is being built The building project calls for a two-story administration building, a wood working plant, 75 x 150 ft., and a general assembly line house to be 75 x 260 ft.

Complete Bellanca Additions

NEW CASTLE (DEL)—Following the recent completion of new building extensions to the Bellanca Aircraft Corporation factory here, it is expected that production in April will be stepped up to twelve, as compared with six per month during the first three months of this year, and later will be increased to a plane a day.

New Firms Announced

EFFICIENCY AIRWAYS, INC., Pittsburgh, Pa, capital $500,000, officers, Joseph de Otto, president, Joseph E. Schuecker, vice-president and secretary, Allen R Willis, treasurer, to operate a passenger service and flying school at a field on the William Penn Highway.

WILKES-BARRE WYOMING AIRPORT COMPANY, Wilkes-Barre, Pa., capital $155,000, officers, William W. Multer and E. G Smith, to manufacture, repair and operate aircraft

BAUPPSTADT AIRPORT COMPANY, Somerset, Pa., capital $5,000, Clara B Cleeves, treasurer, to manufacture, repair and operate aircraft.

ROCHESTER FLYING SERVICE, INC, Gates, N Y, directors and subscribers William G Dunlop, Jeffrey P. Miller, Walter E. Hutchins, to operate aircraft.

SOUTHERN AIRWAYS ASSOCIATION, Columbus, Ga., J. Ralston Cargill, president, to promote a transcontinental aerial highway and to develop airports along its route

ROANOKE AIRWAYS, INC, Roanoke Va, capital $50,000, by J. Slurley and others.

NEW ENGLAND AIR TERMINALS, INC., Portland, Me., to establish and maintain airports and operate aircraft in New England.

NORTHWEST AIR SERVICE, INC, Seattle, Wash, capital of $100,500, by John R. Blum and Melville Monheimer

JOPLIN AIRWAYS, INC, Joplin, Mo, capital of $20,000, by Ralph L Nolen, Eugene R Stotts and Everett Askins.

ATLANTA FLYING SQUADRON, Atlanta, Ga, capital, $60,000, by H. M Dodd, John R Adamson and L. R Cain, to do commercial flying, aviation construction, aerial advertising and airplane repair work.

AVIATION SYNDICATES, INC, Atlanta, Ga, by W H Vermilya, to handle aviation stocks and to gather and distribute information statistics and aviation data

LA ROE AIRCRAFT, INC., at Albany, N Y, capital 2,000 shares non par value stock, by Wilbur La Roe, Jr, Wilbur La Roe, Sr, and Arther La Roe, to manufacture aircraft

FLYING CLUB OF WATERTOWN, INC at Watertown, N. Y., capital $25,000, by Roswell S George, Harold W Conde, and Merton A. Eveleigh, to operate aircraft.

EAU CLAIRE AIRWAYS, INC, Eau Clair, Wis, capital of $20,000, for the purpose of operating a flying school and a regular air taxi and transport service, officers: John R. Davis, president, James S McMillen, vice-president and secretary, and Wesley Ferguson, treasurer.

PORTLAND AIRWAYS at Portland, Ore., by Francis L. Hall, Henry H R Cor and William P Foster, to take over Hall-Clemence Air Service and operate passenger service and flying school

AIRPORTS AND AIRLINES

Thompson Plans New Lake Service

DETROIT (MICH)—Jumping across Lake Erie at regular intervals during the day a fleet of three Keystone Loening amphibions, powered with Wright Cyclone engines, will link this city and Cleveland with a 55-min service. This new passenger line is being promoted by the Thompson Aeronautical Corporation, which already is operating a C A M 27

The local terminal will be on the river about 700 ft. east of the Belle Isle Bridge, adjoining the Naval Reserve tract and close to the financial district The Cleveland terminal will be located at the foot of the Ninth Street east of the Municipal Pier and 5 minutes from that city's down-town center The planes will land on the water and taxi onto the shore, where stations will be built soon. Planes will leave each city at 8 a m, the last flight starting from each city at 6 p m. The date of inauguration has not been announced

Memphis in Curtiss Chain

MEMPHIS (TENN)—This city has been added to the nation-wide chain of airports and air fields owned, operated and participated in by the Curtiss Flying Service A hangar 100x125 ft will be built at the Municipal Hollyford Road Airport for the Curtiss concern. According to Curtiss official negotiations are under way for the purchase of Mid-South Airways The new Curtiss Flying Service of the South will be directed by W H Stovall H G Rosson will be Memphis manager of the Curtiss Flying Service

Mamer Opens Route

SPOKANE (WASH)—Airplane passenger service from Spokane to Portland, Ore, was begun April 15 by the Mamer Flying Service of Spokane. A 15-minute stop is made at Yakima, Wash, en route each way Fare of $28 50 from Spokane to Portland and $20 to Yakima from either terminal has been fixed Taxicab connections will be available at both ends of the route to facilitate quick arrivals at destinations

L & H Erects Grandstand

HARTFORD (CONN)—The L & H Aircraft Corporation, with headquarters at Brainard Field is erecting a grandstand beside its hangar for the use of visitors to the field From the stand there is an unobstructed view of the entire airport Seats will be provided for from 250 to 300 persons

Name Airports of Entry

WASHINGTON (D C) — Detroit, Mich, Great Falls, Mont, Nogales, Ariz, and El Paso and Laredo, Tex, were designated airports of entry April 11

Export Plane Route

NEW YORK (N Y)—Along a route touching 34 Latin American countries will fly the amphibion representing 40 American firms and civic organizations on what is to be called the South American Trade Extension Flight It has been endorsed by the American Manufacturers Export Association and its mission will be to develop further the relations between exporters in this country and prospective purchasers of Central and South America The plane will be about six months covering the route At each key trade center the crew will establish contacts with leading men through the showing of a 10,000 ft motion picture talking film and the presentation to a selected clientele of an 80-page booklet, describing "Industry and the Americas"

Central Plans Extensions

WICHITA (KAN)—E A Watkins, president of the Central Air Lines Company, operating passenger service between Wichita and Tulsa and planning extensions to Omaha and Lincoln Neb, and to Kansas City, Mo, is considering plans now for a line to St Louis A survey will be taken soon to determine patronage. Air mail patronage will not be considered in the survey, as Wichita interests realize established air mail lines will carry the bulk of the mail

Universal Cancels Twin Cities Service

DETROIT (MICH)—Universal Air Lines' passenger service between Chicago and the Twin Cities was canceled Wednesday April 17 Its equipment has been shifted to other routes operated by the concern south of Chicago except for the flying school and general service at the Wold Chamberlain Field in Minneapolis which will be continued.

The route will continue to be flown by Northwest Airways, Inc. which last September inaugurated over it the first co-ordinated air-rail service It is understood that a minority block of Northwest Airways stock formerly owned by Transcontinental Air Transport has been divided with Universal Air Lines

Northwest Airways retains its original independent organization it is said. Two new directors have been added to the board Earle H Reynolds president of N A T., and Col Paul Henderson, of T A T and N A T The company will receive the active co-operation of Universal Air Lines T A T Stout Air Services and N A T as well as six railway systems

Pitcairn to Have Survey Ford

PHILADELPHIA (PA)—Within two or three months Pitcairn Aviation, Inc will take delivery of its first tri-engined Ford transport which will be used for experimental flying on various parts of its New York-Atlanta-Miami airway, with future passenger service operation in mind The company plans considerable investigation before entering the passenger carrying field, and no announcement of its plans are expected before Fall

Standard Transfers Base

PHOENIX (ARIZ)—The local base of Standard Air Lines has been changed from the Municipal Airport to the Phoenix Sky Harbor, without change of schedule. The move was made to provide better accommodations for passengers, Sky Harbor already having a depot where a restaurant is planned for the immediate future and concrete runways are being built

Begin Work on Martin Field

BALTIMORE (MD.)—Work on the 1,200-acre airport and factory project planned by the Glenn L. Martin Company near Middle River has begun The first work, to be done by Potts and Callahan, contractors, will be the removal of trees on the factory site, grading and excavating

Omaha-St. Louis Schedule Announced

OMAHA (NEB.)—The new Omaha-St. Louis air mail line, which begins operation May 1, when the new transcontinental schedules go into effect, will provide round trip service twice daily, although operation of the night run will be delayed because lighting of the airway is not quite completed, local Universal Airlines officials have been notified.

Tentative schedule of the Omaha-St. Louis service is as follows: leave St. Louis at 7 35 a.m. arrive Omaha 12 05 p m, leave Omaha 1 10 p m, arrive St. Louis 5 50 p m. The air distance, via Kansas City, is 403 miles.

Transfer of West Coast mail for southeastern and southwestern cities will be made at Omaha instead of being brought into Chicago as heretofore. Letters for southeastern states will be routed from Omaha over the Kansas City St. Louis-Evansville-Atlanta lines. Those addressed to Oklahoma and Texas will also be transferred at Omaha, connecting at Kansas City with the present Chicago-Dallas lines, where connections will be made with the line from Brownsville, Tex., to Mexico City.

Teletype Aids Weather Men

WASHINGTON (D C.)—Weather reports from here to Hadley Field, N. J., Bellefonte, Pa., and Cleveland by the teletype printer system, which was started in February, is working out satisfactorily, it is reported. Reports are issued twice daily based on information gathered from stations in this country and Canada. Transmission is started at 8 15 a m and 8 15 p m. and continues for about 20 min. Then there is a break of 25 min. for exchange of reports between the airports, and at 9 there is another report from here. The Weather Bureau says that this method permits a more complete volume of reports, as well as greater promptness.

Michigan Tour Sanctioned

PONTIAC (MICH.)—Official sanction of the National Aeronautic Association has been granted for the proposed First Michigan Air Tour and dedication air meet for the local Municipal Airport. The tour is scheduled to start June 10 from this city and return June 14, visiting in the meantime as many cities as possible in the state having an airport with suitable facilities for accommodating a large number of planes. The following two days will be given over to a dedication air meet for the local field. The tour is being sponsored locally.

Pitcairn to Operate Sundays

ATLANTA (GA.)—On account of the heavy traffic over the New York-Atlanta-Miami air mail line operated by Pitcairn Aviation it has been decided to fly on the route on Sunday, beginning May 1, in addition to the six day schedule now in effect.

Pass Oklahoma Airport Law

OKLAHOMA CITY (OKLA.)—The Black airport measure, which permits cities of this state to acquire and own airports, paying for them by bond issues, has been made a law with its signing by Gov W J Holloway.

N. Y. Company Buys Hadley Field

NEW BRUNSWICK (N J.)—Hadley Field, well known as the eastern terminal of the transcontinental air mail lines for several years, has been sold to New York Air Terminals, Inc., the company which also is developing the air terminal at Secaucus, on the New Jersey meadows. Hadley Field will be used as a temporary base for the air concern, it is said.

Plans for a seaplane base at North Beach, Queens, to be in operation by June 15, have been announced. Another seaplane base at Black Tom, N. J., opposite the Statue of Liberty, and a third in the North River between 60th and 100th Streets are being considered. The concern is interested also in leasing the 200-acre terminal for both land planes and seaplanes recently selected by the Westchester County Park Commission at Croton Point on the Hudson River.

Change Packard Field Name

DETROIT (MICH.)—Packard Field, the name of the original airplane proving grounds of the Packard Motor Car Company, has been changed to Gratiot Airport, according to a recent announcement of Howard C. Hartung, president of the Hartung Aircraft Corporation. The Hartung corporation has a lease on Packard Field originally established as a testing field during the World War. The change was made to avoid confusion, between the field and the Packard proving grounds at Utica, Mich., where the Packard company is experimenting with its new Diesel type powered airplane.

Rumor New Southern Line

BIRMINGHAM (ALA.)—It is rumored here that a passenger line from Dallas, Tex., to Atlanta, Ga., by way of Birmingham and Shreveport, La., will be opened as soon as planes can be delivered to Southern Air Transport, the new holding company of Gulf Airlines and Texas Air Transport. According to the reports Travel Air cabin planes will be used on the route and one trip will be made daily.

Gets Vega for Alaska Line

SEATTLE (WASH.)—Aviation Schools, Inc., here has taken delivery of the first of a fleet of six Lockheed Wasp Vega machines equipped with pontoons which have been ordered for its proposed Alaska service. The rest of the planes will be delivered as soon as pontoon equipment has been provided. The first plane has been named "Miss Juneau."

Operators Form Group at South Bend

SOUTH BEND (IND.)—South Bend Aeronautical Trades Association, open to all concerns, dealers and operators active in commercial aviation and associated industries within a radius of 50 miles of the city, has been organized here by four large operators. Its purpose is to stimulate aviation interest in the city and vicinity, promote activities for its development and growth, and establish an ethical basis of competition among dealers.

The four charter members are the Curtiss Flying Service, the Shockley Flying Service, Inc., the State Aircraft Corporation, all of South Bend, and the Kysor Eaglerock Corp., of Niles, Mich. The individuals representing these concerns in the association are: Willis Kysor, of the Kysor corporation; C. L. Snyder, Leo R. Clemens, F. C. Toepp, Jr., and Al DeWitt, pilot, of State Aircraft; Lieut. Clyde W. Shockley, Capt. Charles R. Bowers, Richard W. Tormey, and Forrest E. Kelch, pilot, of the Shockley Flying Service, and Lieut. Charles E. Hastings, of the Curtiss concern.

Maddox Speeds Up Service

ALAMEDA (CALIF.)—In order to care for increasing passenger and parcel traffic, officials of the Maddox Air Lines operating between Alameda, San Francisco and Los Angeles have announced that starting April 1, express and local plane service would be inaugurated. Plans of the company call for the dispatching of two planes daily, one stopping at Bakersfield and Fresno on the trip south and the other making the three-hour run without stop.

Cities Petition For Mail Line

MINNEAPOLIS (MINN.)—Petition for establishment of an air mail line between the Twin Cities and Omaha has been forwarded to the Post Office Department by the Minneapolis Civic & Commerce Association. The petition was signed by civic leaders, the Minneapolis postmaster and business offices using the air mail extensively. Similar petitions have previously been sent by St. Paul and Omaha.

Seaboard Plans Services

WASHINGTON (D.C.)—Atlantic Seaboard Airways, Inc., of which Capt. Ira C. Eaker is operations manager, plans to include in its services a sightseeing service at Hains Point in Potomac Park and sightseeing flights over Gettysburg Battle Field through operation of the Gettysburg Flying Service, Inc.

May Fix Air Traffic Lanes

LOS ANGELES (CALIF.)—Creation of definite air travel lanes above this city has been proposed in the City Council and an ordinance to that affect is now under consideration.

South Dakota Plans Week of Air Events

RAPID CITY (S. D.)—Statewide interest in aviation is to be aroused when one of the greatest series of aviation events ever staged in South Dakota will be held from April 29 to May 4. Although many communities will be holding appropriate meetings and events the major activities will be concentrated at six of the leading airports. The mayor of each of the six cities will declare a local holiday when their respective fields are being dedicated.

The schedule of events begins on Monday, April 29th with the official spring opening the Rapid City airport, April 30th, dedication of the Huron airport and the inauguration of the air-rail service furnished through the cooperation of the Rapid Air Lines, Inc., and the Chicago, Northwestern Railroad in which train passengers from Omaha and the Twin Cities make connections with the plane here for Rapid City, saving two full days on round trip to the Black Hills from the East, May 2nd, official opening and dedication of the Watertown airport, May 3rd and 4th, undecided, but to be announced.

Government Airway Positions Now Open

WASHINGTON (D C.)—The Civil Service Commission has lately announced a competitive examination for the position of inspector of airways construction, applications to be on file with the Commission at this city not later than May 14. Entrance salaries range from $2,300 to $2,800 per year.

The duties consist of the inspection of the work of contractors engaged in the installation of lighting facilities along the civil airways. The work comprises the installation of wiring, fittings, etc., and the installation and putting into commission of various styles of electric and acetylene beacon lights, as well as gas engine driven generators, the inspection of structural steel, concrete, and wooden structures.

Surveys Montana-Mexico Line

PORTLAND (ORE.)—A survey of the proposed air line from Billings, Mont., through Portland to the Mexican line is now being made by L. L. Bruning, airplane distributor. Mrs. Edith Foltz, Portland pilot, will fly from Portland to the California line with Mr. Bruning. At the California border another pilot will take the plane south.

Open Virginia Airport

CLIFTON FORGE (VA.)—The local airport, five miles east of this community and about one hour by automobile from Hot Springs and White Sulphur Springs, Va., has been commissioned. It is a two way field with runway 1,700 ft. long, 600 ft. wide, and is one of the few satisfactory landing fields in this section.

Gildersleeve Plans Service

CINCINNATI (O.)—Plans of Clifford Gildersleeve of Cleveland to establish a passenger line between Cleveland, Columbus and Cincinnati, are favorably regarded by local city officials. Gildersleeve wishes to use the Municipal Airport as a landing field for his service. The new company purposes to begin passenger service with three Ryan cabin planes carrying five passengers. Subsequently, if traffic warrants, Gildersleeve said his company would use tri-engined planes.

Arizona Passes Three Air Laws

PHOENIX (ARIZ.)—Three laws bearing on aviation passed by the last State legislature and recently signed by Gov. John C. Phillips are designed to place Arizona in the ranks of progressive states in this regard.

The first is the Uniform State Law for Aeronautics, passed practically without alteration. The second makes it unlawful to operate an unlicensed aircraft, or to fly within the State without a Department of Commerce License. The third statute gives any city, village, town, or county within the state authority to purchase, lease, construct, improve, equip, operate and maintain airports and landing fields which may be within or without the bounds of such governmental unit. This may be done by direct taxation or by bond issue, and eminent domain may be invoked for the purpose of acquiring lands.

To Establish Chinese Service

ST. LOUIS (MO.)—Forty planes and a corps of experienced pilots are to be sent by the Curtiss Robertson Airplane Manufacturing Company to inaugurate a commercial aviation and air mail service in China sponsored by the Chinese Government. The project has been worked out by Maj. William B. Robertson who is now on his way home from China. About $2,000,000 is understood to be the local concern's investment in the project.

Completing Oakland Port Hotel

OAKLAND (CALIF.)—With 37 rooms available to guests, the new Airport Hotel at the Oakland Airport here will be opened to the public within the next two months. It has been learned from H. P. Speicher, operator of the Oakland Airport restaurant. The hotel will be one of the largest and finest to be found at any flying field in the West.

Enclosed Beacon Developed by G.E.

SCHENECTADY (N. Y.)—A new type of revolving airport beacon, with all of the moving parts enclosed within a glass dome and with a beam that in clear weather can be seen by pilots 66 miles away, has been developed by the General Electric Company. The 20-in. deep parabolic mirror, the automatic lamp changer equipped with two 1000 watt 115 volt airway beacon lamps, the louvres for cutting out stray light, and the rotating mechanism are all enclosed within a 24-in. hemispherical, heat-resisting glass dome. All of the parts can be inspected through the glass, and the glass dome is hinged providing easy access to all of the mechanism.

In the new type of beacon a deep parabolic mirror is used, with the filament of the lamp at the focus of the mirror and at the same time even with the edge of it. This arrangement gives the beam an acceptance angle of 180 deg., as against the 120-deg. angle of the usual beacon. The beam spread is 7½ deg., and the beam candlepower 1,075,000. Zenith indication is obtained at all points, with the distinctiveness of the beacon increased by an eclipse during each revolution.

Government Names Two for Lehigh Board

WASHINGTON (D. C.)—Col. Harry H. Blee and Maj. Ernest Jones have been selected for the Program Committee of the Lehigh Airport competition, a nation-wide airport design contest for $10,000 in prize money under the auspices of the Lehigh Portland Cement Company, closing November 18.

The Aeronautics Section of the Program Committee includes Dr. George W. Lewis, Col. Paul Henderson, Charles S. (Casey) Jones, Porter Adams, L. K. Bell, Maj. John Berry, and Harry Schwarzschild. Harvey Wiley Corbett, New York architect, is chairman of the program committee and the architectural section. He is assisted by Raymond Hood, Prof. William A. Boring, Parker Morse Hooper, and Francis Keally.

The engineering section includes Morris Knowles, Gavin Hadden, Francis Lee Stuart, Harold M. Lewis, and Col. Willard Chevalier. The civics and city planning section includes George B. Ford, Hon. Fred C. McLaughlin, E. P. Goodrich, Harold Buttenheim, and Samuel T. Wetherill, Jr.

Southern Adds Line

HOUSTON (TEX.)—Passenger service between this city and Fort Worth via Waco and Dallas was inaugurated April 4 by Southern Air Transport, Inc. The line will be extended to Galveston when facilities in that city have been provided. The concern is now operating about 40 passenger and mail planes over about 4,000 miles of airways daily.

FOREIGN ACTIVITIES

Mexican Aviation Co. Has Long Experience

NEW YORK (N. Y.)—The Mexican Aviation Company which now is carrying the air mail between Brownsville, Tex., and Mexico City, in tri-engined Fords is the direct descendent of a picturesque organization which started its flying career as far back as 1920 and with only two Standards of honored memory as flying equipment. The title which the concern now bears was applied only last fall when fresh blood through the Aviation Corporation of the Americas was brought into the original company.

The Mexican Air Transport Company, as it was known first, was organized to ferry passengers and company mail, and miscellaneous goods between Mexico City and Tampico for coffee and oil interests. Following the growth of aviation, the concern in later years added Fairchild cabin planes and now has entered the air mail business over expanding lines, the climax coming on March 9 when the Fords went into active service on the Brownsville-Mexico City route.

Shortly before the opening of this line, the company began operation of a strictly Mexican line which is even longer than that to this country. It extends between Vera Cruz and Merida, Yucatan, with stops at Minatitlan, Villa Hermosa, Ciudad del Carmen and Campeche. This is called Division 2. This line is to meet Division 1 at Tampico and will connect also soon with the Pan American service, between Miami and the Canal Zone at the island of Cozumel, east of Merida, as soon as a landing field has been prepared there.

Dutch to Use English Airports

THE HAGUE (HOLLAND)—The operations of this country's ambitious air line plans to the Dutch East Indies which was carried out at intervals last year and in spite of extremely unfavorable conditions, are to be aided in the future by the use of English airdromes along the airway, permission for which has been granted recently. One of the greatest obstacles encountered by the Dutch machines on the long flight was the absence of suitable landing fields.

English Air Mail Increases

LONDON (ENGLAND)—Almost 37,000 lb. of letter air mail were flown from England in 1928, representing an increase of 36 per cent over 1927. Planes on the Cairo-Basra service carried almost 20,000 lb. as compared with 13,500 lb. in 1927.

Foreign News Briefs

Seven laps of 31 miles each around the quadrilateral course for the Schneider Trophy Race at Cowes this year have been substituted for the five laps originally planned.

Mexican and American capitalists are reported organizing a $5,000,000 company to operate an air mail and passenger service between Rio de Janeiro and San Francisco by way of Mexico City and various capitals of Central American countries.

Colombia is sending an aeronautical mission to this country to study aviation here. This mission will visit European countries and Argentina also, it is expected.

France has launched its second airplane carrier, a 10,000 ton vessel accommodating 26 seaplanes and flying boats. The ship is 547 ft. long, has five electrical cranes for hoisting the machines on board and four catapults for launching the planes. It carries a crew of 43 officers and 606 men. The ship will have a speed of 20 knots.

Passenger service between Colombia and the Canal Zone was scheduled to have started Wednesday, April 17, by Scadta. The company has been carrying mail between the Canal Zone and South American points.

Kingston, Ontario, Flying Club has been added to the chain of flying clubs organized in Canada under Government subsidy.

A French movement for air marking of the principal cities along the country's airways is being given considerable emphasis.

Van Lear Black, whose Cape Town-London flight in his tri-engined Fokker (Whirlwinds), was forced down at the French-Italian border April 3, still plans to carry out his round trip flight to Japan and expects to take off in his repaired plane the latter part of this month.

There is agitation in Buenos Aires, Argentina, for construction of a dirigible base there in anticipation of trans-Atlantic airship service between that city and Seville, Spain.

Gasoline derived from coal has been under test recently at Stag Lane Airdrome, London, in both medium and high power engines under auspices of the British Air Ministry. The fuel, obtained from low temperature carbonization processes, is to be tested further before its utility is conclusively judged.

The Royal Dutch Air Line has started a special freight service between Holland and England to meet the demand for freight space which has increased tremendously. The Fokker monoplanes of the company are filled to capacity every day, it is reported, flowers and vegetables from Holland forming a large proportion of the cargoes.

British Columbia Airways is reported negotiating with the Washington Air Express, Inc., of Seattle, for an amalgamation of the two companies as the routes over which the two concerns have been operating practically coincide.

Sir Charles Wakefield, generous patron of English commercial aviation, has given the new Aero Club of East Africa a light plane. He has made similar gifts to other clubs and has been the backer of Sir Alan Cobham's flights to Australia and South Africa.

Italy Holding Light Plane Test

ROME (ITALY)—Fiat, Macchi and Caproni light planes are reported unofficially to be the three that will take part in the final test which the government is conducting to decide on the official light planes which it will furnish to the subsidized flying schools and flying clubs throughout Italy. For other planes taking part in the early tests, included the Romeo, the Piaggio, the Breda, the Cantiere, and the Montefalcone machines.

The test includes a 100-hr. flight, a series of five-hr. flights in which the fuel and oil consumption are tested, tests on landing and take-off performances and speed in horizontal flights and climbing. The final test, in which an approved Italian engine must be used, will be a flight of about 2,500 miles around Italy. The engine were being tested for installation in the approved plane and the Fiat seven-cylinder radial of 85 hp., the Isotta Fraschini six-cylinder vertical of 85 hp. and a Colombo four-cylinder of 85 hp.

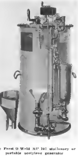
German Air Budget Cut

BERLIN (GERMANY)—Aviation in this country is believed to have received a severe blow with the cutting of the budget assigned to the various interests. Luft Hansa's budget of 19,000,000 Marks has been cut in half, threatening the dismissal of about 60 per cent of the personnel and a curtailment of expansion plans. Cancellation of the 4,500,000 Marks subsidy for the Zeppelin works may halt new airship construction and the Zeppelin backers have intimated intention to seek American capital to make possible its proposed building program.

THE BUYER'S LOG BOOK

MP-101 Acetylene Generator

TO meet the demand for a stationary or portable acetylene generator adaptable for use in connection with either medium pressure or low pressure welding and cutting blow pipes, the Oxweld Acetylene Co., 30 East 42nd St., New York City, has developed the Prest-O-Weld Type MP-101 medium pressure acetylene generator. This generator can easily be carried from place to place on a truck or wagon. Heavy gage material has been used in the construction of the generator and bronze welding has been employed for joining the shell and fittings. All parts are either galvanized or sherardized according to the conditions to which they are likely to be subjected.



The Prest-O-Weld MP-101 stationary or portable acetylene generator

The carbide valve is rotated by means of a spring clock motor which in turn is governed by an Oxweld diaphragm type motor feed control. This rotating speed valve is self-cleaning, the carbide brushing off any dust or lime deposit as it is spread. A pin in the stem above the valve prevents bridging of the carbide and consequent possible stoppage. There is nothing to get out of order in the carbide feed mechanism. The motor is inclosed in a dust-tight housing.

Pressure adjustment is easily made by means of a thumbscrew on the motor feed control. The operation is very sensitive. Fluctuation during normal operation is less than 1 lb. per sq.in. and even under severe load the carbide feed is regulated to limit after-generation to a maximum increase of 1 lb. per sq.in.

Should, by any chance, both the motor brake and relief valves fail to function, the motor locks at about 18 lb. per sq.in. pressure, thereby stopping the carbide feed. Should a broken line or leak of any kind cause the pressure to drop to zero during operation, the motor stops and will not start except by hand.

Time required for shutting down the generator, flushing and refilling with carbide and water is about 15 min. Relief valves are opened by raising an interference rod to vent the air-gas mixture after refilling so that it is unnecessary to vent hose or pipe lines to the generator.

The feed valve cone can be raised to seal the hopper when the generator is being moved. This valve is also automatically raised, closing the hopper every time the carbide filling door is opened. The hopper and generator body are so designed that no water will enter the hopper in case the generator is knocked over.

The hydraulic back pressure valve and filter are contained in a seamless drawn shell with a flange cover and outlet casting, bronze-welded to the shell. The cover can be removed for repacking the filter. An interference rod permits opening the water filling cock only while the relief valves are open. The Underwriters' Laboratories have permitted a double rating for the MP-101 generator making its rated capacity 60 cu. ft. per hour.

The carbide capacity of this generator is 30 lb. and the quarter size (1/4x1/12 in.) carbide is used. A special funnel, which is held in place on top of the generator, is provided for filling the generator with carbide. The overall dimensions of the generator are: height, 60 in. and width, 34 in. The weight empty is 305 lb. With a full charge of carbide and water, the total weight is 623 lb. The weight crated for shipment is about 455 lb.

Bundy Airplane Hangars

THE BUNDY hangar, offered by Carey Bundy, Pittock Building, Portland, Ore., is designed to house separately, individually and independently any number of airplanes in a single structure. Plans are furnished

A Bundy hangar showing use of space above tail of plane

under license or contracts are accepted for construction of these hangars which are built of any desired combination of materials. The individual compartments in the hangar structures are "T" shaped, and so placed that alternate compartments open on the same side of the structure. Light weight accordion type doors are employed.

A machine shop, store room, office or sleeping quarters can be built into the space above the tail.

Airplane Fueling Truck

A NEW type of service truck for refueling airplanes was recently approved by the U S Army Air Corps at Wright Field, Dayton, O This truck is manufactured by the Columbian Steel Tank Company of Kansas City, Mo, which has received an order for four more all of which will be used at Wright Field

The truck which has been approved by the army is equipped with a 1200 gal gasoline tank, 100 gal oil tank, 100 gal water tank and an air compressor tank. The pumping apparatus and valves controlling the several tanks are located directly in front of the main gas tank

One of the smaller tanks in use at the Tulsa, Okla Municipal Airport

and directly back of the driver's cab Power for forcing the fuel into the tanks of the airplane or dirigible is supplied from the truck engine

Meters and glass gauges indicate the amount of fuel in the truck tanks and the plane can be refueled or emptied by reversing the pumps

In addition to building this large type service truck the Columbian Steel Tank Company is also manufacturing a smaller truck for use on municipal airports This type truck carries smaller tanks and is manufactured with both hand pumps and power pumps

Realizing that fuel can be taken to airplanes, especially the large transport craft and dirigibles, much easier than the plane can be taxied to a fixed fueling station has prompted the Columbian organization to expand their business to take in this phase of the aviation industry

Gisholt Balancers

THE elimination of vibration in an airplane engine is of even greater importance than in an automobile engine Airplane power plant manufacturers are following the lead of the automobile men with the result that the efficiency and life of many well known aviation engines has been greatly increased Airplane engine manufacturers have found, however, that it is necessary to balance not only the crankshaft but also the propeller.

For propeller balancing the Gisholt Static Balancer has proved highly successful This machine is really a fine laboratory testing device which has been developed for production purposes Despite the large output of the machine and its simplicity of operation, it is sensitive to an unbalance of only 2 of an ounce inch It will test this minute amount of unbalance in propellers or similar objects for which it is adapted

For balancing crankshafts and other revolving parts the Gisholt Precision (Dynamic) Balancer has many features which appeal to airplane motor manufacturers This machine also is sensitive to 2 of an ounce inch and combines ease of operation with unvarying accuracy under production schedules

SIDE SLIPS

By Robert R Osborn

Mr M A G of Holyoke, Mass, sends in a note describing the "Silver Cloud," a diminutive low-wing monoplane belonging to Captain Isaacs of Pittsfield, Mass, an old English army flyer, who built the craft himself It is also known as the "Demi-Tasse" It has a Chevrolet motor, a Ford radiator and other oddities which distinguish it easily from ordinary commercial ships Its ceiling is said to be between five and six feet

Obviously designed for the great group of people who, when solicited for rides at the flying field, say they'd go up if they could keep one foot on the ground

• • •

Mr R. J. W of Garden City, N Y, sends in a clipping describing the purchase of "six Ryan-Mooney biplanes" by some one and asks for some information on this new company

We don't recognize the company either but suppose it is the result of one of the many mergers going on all about us

• • •

"BYRD'S DOGS GET WELL EARNED REST" *Headline in N Y Post*

We suppose that walking around an icy and snow-drifted Antarctic landscape must be hard on one's feet.

• • •

We see by the papers that a rousing welcome and street parade patterned after our American demonstrations are planned for Major Segrave and The Golden Arrow car when they arrive in London If the same newspaper correspondents, afflicted with eye trouble, who covered the Florida speed trials are assigned to the parade we can expect something like the following

"There was a parade from Waterloo station to the Houses of Parliament today None of the spectators was able to turn his head fast enough to see what it was, but, according to reliable reports it consisted of Major Segrave in his Golden Arrow car accompanied by the Police Band and Grover Whalen"

• • •

"LADY HEATH FLIES BIPLANE 115 MILES AN HOUR." *Headline*

And now what have those scoffers to say,—those who used to say the airplane would never amount to anything? We predict that speeds of 125 miles an hour will even be possible some day

• • •

"Minneapolis, April 9 (A P) Charles (Speed) Holman, the winner of various competitive air fights, successfully negotiated an outside loop in a biplane today. He was said to be the first flier to perform this feat with an open biplane"

Possibly it was the first outside loop in a biplane carrying an electric stove?

Is Your Investment Protected?

You have a considerable investment tied up. An accident or two (it does happen) and that investment is reduced considerably. Not alone the investment in the ship . . . supposing there are passengers . . or you hit somebody . . or you damage property . . . then what?

There is only one sure way to protect your investment . . . by insuring with a company that knows both insurance and aviation from the operators viewpoint.

Auer Incorporated operates its own planes. As a result they have been in a position to design new policies that meet the particular demands of the aircraft industry.

Ask about them.

"SERVICE AN IDEAL SINCE 1860"

AUER

INCORPORATED
CENTURY BUILDING, MILWAUKEE

When flying in the Southwest, use the products of Magnolia Petroleum Company; and on the Pacific Coast standardize on the products of General Petroleum Corporation. These are two important subsidiaries of Standard Oil Company of New York.

Moth company officials making sure that everything is ship-shape prior to the test flight which proved so successful

First Moth Plane is launched on test flight with Socony Aviation Gasoline

THE Moth Airplane Corporation of Lowell, Mass., is another enthusiastic user of Socony Aviation Gasoline. Their first Gipsy Moth assembled in America was fueled with Socony Aviation Gasoline on the occasion of its test flight to New York City.

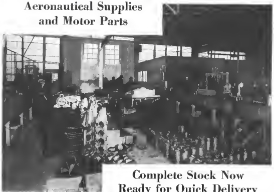
You will find Socony Aviation Gasoline and Aircraft Oils readily available throughout New York and New England. Look for the familiar red, white and blue Socony sign.

SOCONY

AVIATION GASOLINE
AIRCRAFT OILS

STANDARD OIL COMPANY OF NEW YORK

Aeronautical Supplies and Motor Parts



Showing the OX-5 Assembly Plant of the Robertson Aircraft Corporation. Here is the largest stock of OX-5 parts in the United States.

All sizes wheel discs die stamped and accurate. Size 28x4 $3.00 pr

AN Nickle Steel bolts nuts clevis pins guaranteed and genuine. All sizes

Navigation Lights regulation style $15.00 set

Spinner caps accurately turned and finely finished most sizes $2.00

Tubing streamline and round

Any and every aviation need promptly shipped

Authorized Wright Parts Dealer with parts for Whirlwind motor in stock

The new Parts Catalog is complete representative and honestly helpful. Write for your copy

Complete Stock Now Ready for Quick Delivery

Robertson dependability has long been known throughout the aviation industry. Robertson never substitutes. All parts are strictly standard or made to AN specifications. Every item is guaranteed.

Now, with the enormous purchasing facilities afforded through merging with the Universal Aviation Corporation, Robertson has been able to buy in quantities that permits the offering of a complete stock of aviation supplies at lowest prices obtainable.

Robertson dependability, Robertson promptness in making deliveries and Robertson low prices afford the aviation industry a service which has long been needed. A new catalog is just coming off the press and will be sent you on request.

Write for your copy today.

Dept. W-4

ROBERTSON AIRCRAFT CORP.

Lambert-St. Louis Airport, Anglum, St. Louis County, Mo.

For quick service phone Avery 2725

DIVISION UNIVERSAL AVIATION CORPORATION

N478

To keep materials abreast

TO makers of aeroplanes, du Pont offers a complete line of finishes that are always abreast of the most modern trends in aircraft design Du Pont Wing Dopes and other special products are built to protect and beautify every surface of your ships against the worst that heat, cold, sun and weather can do

Standard Army and Navy finishing materials, and special du Pont systems—for wings, for fuselage, for every part of your aircraft—now make it possible to base your complete finishing schedule on du Pont's many years of experience in the field of scientific aeroplane construction

Every du Pont aircraft finish has been tested in the most gruelling flying service

Du Pont laboratories are constantly developing scientific finishes and fabrics—creating greater beauty—producing higher durability

Style and color now important—utilize this Color Service

Du Pont brought color to the motor car and to the home Now, with du Pont Wing Dopes, Duco, and other special finishes, you can give your ships the last word in color The du Pont Color Advisory Service has studied trends in aircraft color, both in America and in Europe They will be glad to suggest suitable harmonies Do not hesitate to call on them as well as on the du Pont technical men

Complete information on any du Pont product for airplane use will be furnished promptly by mail or by a qualified representative

AIR-TESTED FINISHES

Du Pont Dopes—The du Pont line of aircraft finishing materials includes clear, semi pigmented and pigmented dopes They are all tested formulas of remarkable durability—proven in service as well as in the laboratory Flexible and highly blush-resistant, the Army and the Navy have approved these products for their requirements Available in a wide variety of highly visible colors

Du Pont Paints and Varnishes—Du Pont chemists have developed a complete line of paints and varnishes including Dopeproof Paint, Spar Varnishes, Fuselage Varnish and Aircraft Enamels

DU PONT
REG U S PAT OFF

E. I. DU PONT DE NEMOURS & CO., Inc.

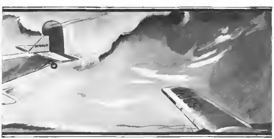
Industrial Finishes Division, Parlin, N J

2100 Elston Ave., Chicago, Ill — 351 California St, San Francisco, Cal.

Flint Paint and Varnish Limited, Toronto, Ontario, Canada

MEMBER OF AERONAUTICAL CHAMBER OF COMMERCE

# of modern aircraft progress



HIGHER standards of convenience and style have now become a vital factor in modern aircraft construction The growing popularity of travel by commercial air-lines—the increasing use of privately-owned ships—demand many new refinements in the planes themselves Upholstered seats, attractive cockpits, better lights and windows—these are some of the problems to be considered by present-day designers

The progressive aircraft manufacturers today realize that du Pont Pyralin and Fabrikoid are materials pre-eminently suited to their needs Very light, durable, resistant to the severest air conditions, these two du Pont products are making possible new refinements in construction

Let us send you data that applies to your specific problem

Pyralin and Fabrikoid—air-tested for the modern cabin

The advantages of Pyralin, 100% transparent, for windows, instrument boards and wing lights are significant to modern airplane builders If you don't already know them, get in touch with us This remarkable material in various colors and effects also has unlimited decorative qualities

Fabrikoid for upholstery brings to the cockpit or cabin a beautiful covering with lasting qualities The designs of the new light-weight Nemoursa Aeroplane Fabrics for cabin ships portray the buoyancy, luxury and gay spirit of the modern mode of travel

Du Pont technical men have wide experience in the field and are always ready to co-operate with you whole-heartedly on your problems Please write to the division concerned

AIR-TESTED MATERIALS

Du Pont Fabrikoid Sturdy Fabrikoid is an ideal material for open cockpit upholstery Will withstand varying weather conditions "Nemoursa Aeroplane Fabrics" are new type, light weight materials developed for interior trims of cabin ships Made on a high grade woven cotton base and treated with appropriate pyroxylin colors Embossed in distinctive patterns

Du Pont Pyralin A strong, durable, light, unbreakable transparent material furnished in any gauge from .5-.000 upward in sheets approximately 20 in x 50 in Ideal for windshields, cabin windows running lights and other uses

DU PONT
REG U.S. PAT OFF

E. I. DU PONT DE NEMOURS & CO., Inc.

DU PONT VISCOLOID CO, Inc

330 Fifth Avenue, New York City

FABRIKOID DIVISION — Newburgh, New York

SUPPLIERS UNDER CONTRACT TO UNITED STATES GOVERNMENT

The inherent stability of the Ryan is like the "come-back" of the boxing dummy

STABILITY *versus* BALANCE

Heretofore, aircraft balance has been as precarious as a juggler's trick

TAKE the stick and convince yourself regarding the new Ryan Brougham for Six. You will agree that its ease of handling, stability and sureness of control widen the margin of superiority which the world concedes to Ryan.

You will grasp the difference between merely a delicately balanced ship that will fly "hands off" only after a close adjustment of the stabilizer, and the new Ryan which comes back smoothly, automatically, and with certainty after being deliberately forced out of normal flight.

The Ryan differential aileron control is so quick and smooth that it is best left alone, in fact, the ship will bank automatically if the rudder is used and can be easily steered by the ailerons. Directional control has been perfected to a degree that is a delight to mail pilots and other cross-country flyers.

To meet the new Ryan production schedule, now in full swing at the St. Louis plant, contract has been let for more than a million and a quarter dollars' worth of the new Wright Whirlwind 300 horsepower J-6 engines.

Early deliveries of the new Brougham are now obtainable through Ryan distributors at principal airports throughout this country and abroad. Write for new illustrated catalog.

THE MAHONEY-RYAN AIRCRAFT CORP'N
LAMBERT-ST. LOUIS AIRPORT
ANGLUM, ST. LOUIS COUNTY, MISSOURI

F. DeC. Ball, President and Chairman of Ryan Board, Col. Charles A. Lindbergh and J. J. "Red" Harrigan photographed after Col. Lindbergh's recent test flight in the new Ryan

The New RYAN BROUGHAM for Six

SISTER SHIP OF THE "SPIRIT OF ST. LOUIS"

PRESTIGE

Stromberg carburetors are used as standard equipment by—

AIRCRAFT ENGINE CORP.
THE ALLIANCE AIRCRAFT CORP.
ALLISON ENGINEERING CO.
AXELSON MACHINE CO.
CURTISS AERO. & MOTOR CO.
FAIRCHILD CAMINEZ ENG. CORP.
KINNER AIRPLANE & MOTOR CORP.
LeBLOND AIRCRAFT ENGINE CO.
NAVY DEPARTMENT
PRATT & WHITNEY AIRCRAFT
VELIE MOTORS CORP.
WAR DEPT.—AIR SERVICE
WARNER AIRCRAFT CORP.
WRIGHT AERO. CORP.

THE FACT that the man on the street—the mechanic in the shop—the engineer in the laboratory—know and recognize that STROMBERG stands for dependability of performance—

THE FACT that recognition of Stromberg dependability has come as a result of years of efficient service on all types of aircraft—

THE FACT that behind this recognition is a record of honest work, expert craftsmanship, and real merit—

Do not these facts lend PRESTIGE to the name of Stromberg—and to every name associated with it?

STROMBERG MOTOR DEVICES COMPANY
58-68 E. Twenty-fifth Street CHICAGO, ILL.

FACTORY BRANCHES

New York, N. Y. *Detroit, Mich.* *Minneapolis, Minn.*
Kansas City, Mo. *London, England*

THE ARROW SPORT

The Talk of the Show

A few weeks ago we announced that the Arrow Sport, powered with 90 H.P. LaBlond engine, would be displayed at the Detroit All-American Aircraft Show.

The talk of the show . . . that is the consensus of opinion. Nationally known pilots were astounded at the wonderful performance of this remarkable ship. Distributors placed orders for 131 ships during the first four days of the show.

Such a reception must be deserved.

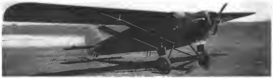
"Watch the Arrow Sport go straight to the heart of America."

Arrow Aircraft and Motors Corporation

Havelock, Nebraska

Northeastern Distributors, Eastern Arrow Aircraft Corporation
5 East 57th St., New York City, N. Y.

THANK YOU *for mentioning* AVIATION



A New ROBIN OX5 Altitude Record

CURTISS FLYING SERVICE, *Inc*
SYRACUSE BRANCH SYRACUSE AIRPORT
SYRACUSE, N. Y.

Airplane Sales Service

March 28, 1929

Kendall Refining Co.
Bradford, Pa.

Gentlemen:

I advised your Mr. Gilbert yesterday that I had on last Sunday established a new altitude record for Curtiss OX-5 Motor powered planes. This record, slightly over 16,000 feet, surpasses by more than 4,000 feet the former official record.

For some time past I have used Kendall Oils in my own ships. When I came here with Curtiss Flying Service, I suggested the use of Kendall and used it on my recent altitude flight.

My Curtiss Robin performed wonderfully. The motor kept an even oil pressure of 52 pounds throughout the three hour flight and never fluctuated once. The temperature outside the cabin was approximately 15 to 20 degrees below zero. Also the motor kept good temperature though of course, it gradually decreased with height. I find that Kendall seals my motor better at an altitude and keeps better revolutions. Not only that, but I have had no trouble in starting even during the recent winter weather. I find that my motors reach and hold consistent oil pressure much quicker than other oils I have had occasion to try.

Kendall Oils certainly are everything you claim them to be, and it gives me great pleasure to tell you of my experiences with it.

With kindest regards, I am

Very sincerely,

Edward J. Devereaux
Edward J. Devereaux
Operations Manager

EJD/RD

—with Kendall Penzbest Oil, of course

A world-famous engine, a splendid ship and the finest lubricating oil available to aviation, form a combination from which outstanding results can be expected. So it was last month when Operations Manager, Edward J. Devereaux of the Syracuse Branch, Curtiss Flying Service, Inc., achieved 16,000 feet altitude in a Curtiss Robin, bettering by more than 4,000 feet the former official altitude record for planes powered by Curtiss OX5 motors.

In his letter reproduced on this page, Mr. Devereaux gives credit to Kendall Penzbest Oil for these results:—Even oil pressure of 52 lbs. throughout the three hour flight, better piston seal and better revolutions at high altitudes, good motor temperature at 15 to 20 degrees below zero, oil pressure reached and held quicker than with other oils.

The testimony of leading pilots throughout the country is in accord with Mr. Devereaux's high opinion of Kendall Penzbest Oil. Many similar letters, all based on actual performance, are in our files. The results achieved with Kendall Penzbest are due to its base—the finest ever found by man—the Bradford Grade of Pennsylvania Crude—perfected by a refining process so highly developed that the wax impurities have been removed almost to the vanishing point. Kendall Penzbest Oil stands up for 30 and more hours of flying without change. No better oil has ever been put into a motor.

For a list of Airports where Kendall Penzbest is now obtainable, address Aviation Division, Kendall Refining Co., Bradford, Pa.

KENDALL PENZBEST MOTOR OILS

KENDALL PENZBEST MOTOR OIL

REFINED FROM 100% BRADFORD GRADE OF PENNSYLVANIA CRUDE

USE THE AIR MAIL

THANK YOU *for mentioning* AVIATION

AVIATION April 20, 1929 1357

AIRPORT LIGHTING EQUIPMENT

Type DCB24

This new revolving beacon was built by Crouse-Hinds Company to meet the specifications of the United States Department of Commerce and is the government standard for use on airways

This beacon can be furnished with a magnetic lamp changer and zenith lights which enable the aviator to locate the beacon after he has passed over the main beam.

Everything in lighting equipment for airports and airways.

Type AKP24 floodlight is entirely new in principle and design It consists of a glass reflector of such design that the vertical spread is limited to a very few degrees but the horizontal spread is 180 degrees. This projector is designed particularly for lighting the landing area of an airport.

Type AKP24

Everything in lighting equipment for airports and airways.

CROUSE-HINDS

SYRACUSE, N. Y., U. S. A.

Sales Offices

PHILADELPHIA NEW YORK DETROIT PITTSBURGH CINCINNATI BOSTON CLEVELAND ATLANTA CHICAGO ST LOUIS SAN FRANCISCO MINNEAPOLIS MILWAUKEE

C-H431

THANK YOU for mentioning AVIATION

THE WACO "220" TAPER-WING

A MAN'S ship, gentlemen, built for he-man usage!

Do you want *speed?* You can shove the air-speed indicator up to 140 and over, and hold it there as long as you care to. With 220 horse power, you can really get somewhere in *this* ship. The Transcontinental Air Derby last year proved that!

Do you want *performance?* Take the stick and put the WACO Taper-Wing through its paces. You will get the thrill of your life. Such instant responsiveness and absolute certainty of control you never before experienced. Yet it's steady as an arrow when you want to relax and fly hands off. And, like every WACO, it asks no favors of a landing field. You can get in, and out, without the least trepidation.

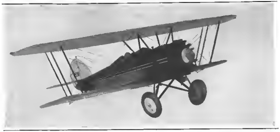
Do you want *reliability?* It bears the pride-mark of WACO. That is your assurance of flawless craftsmanship . . . of rugged strength . . . of *plus* value.

Do you want *appearance?* Its trim lines are noteworthy anywhere. And its custom finish, with choice of colors and matching upholstery, give free rein to the expression of your own individuality.

You, too, will be proud of your Taper-Wing WACO with its masterly performance and distinguished beauty.

The WACO "220"
Taper-Wing
J-5 Wright "Whirlwind" Motor
(220 H. P.—9 cylinder)
Metal propeller
Bendix brakes
Navigating equipment
Dual controls
Customer's choice of colors
$8525

WE are preparing a book on the formation of Aviation Clubs. If interested, reserve your free copy now.



THE ADVANCE AIRCRAFT COMPANY, TROY, OHIO

WACO AIRPLANES

"ASK ANY PILOT"

WIND and storm—the wear and tear of rain and sleet—all of these are destructive agents that Glidair Finishes successfully resist.

The combination of years of practical manufacturing experience and constant research—coupled with the extensive manufacturing and distributing facilities of this company, has produced a successful line of airplane finishes—*within quick shipping distance of every manufacturer.*

This availability, plus the high merit of Glidair products, is to both manufacturer and operator a factor of confidence.

Into the blue of the distant view—Man made and man controlled—On and on—these winged couriers of the sky

GLIDAIR FINISHES *are:*

Glidair Clear Nitrate Dope	Glidair Sper Varnish	Glidair Wood and Metal Preserving Oil
Glidair Clear Acetate Dope	Glidair Aluminum Mixing Varnish	Glidair Metal Primers
Glidair Pigmented Dope	Glidair Dope Proof White	Glidair Enamels for Wood and Metal
Glidair Semi-pigmented Dope	Glidair Flexible Lacquers	

THE GLIDDEN COMPANY
NATIONAL HEADQUARTERS, CLEVELAND, OHIO

GLIDDEN
EVERYWHERE on EVERYTHING

THE transfer of our personnel to new headquarters, on the seaboard, at Baltimore, is the first step in a program of wider service to the development of the art of aeronautics.

MARTIN U.S.A.

MARTIN U.S.A.

THE GLENN L. MARTIN CO.
Builders of Quality Aircraft since 1909
BALTIMORE MARYLAND

THANK YOU *for mentioning* AVIATION

TRUSCON

EFFICIENT HANGARS

Quickly Erected
Economically Priced
Fireproof Throughout

Types and Sizes of Truscon Hangars and Steel Doors for every requirement

These fireproof Truscon Hangars have unobstructed floor spare and full opening doors to insure utmost ease in handling airplanes. They are designed to meet individual conditions with machine shop attached if desired. Truscon Hangars are fireproof throughout with steel windows, steel doors and insulated Steel-deck roofs, all manufactured completely in the Truscon plant. Prompt delivery, quick erection and economical cost insure all-round satisfaction and greatest value. Write for suggestions and quotations.

STEEL HANGAR DOORS

Truscon furnishes steel hangar doors adapted to any type of construction or hangar design. They are sturdily built of quality workmanship, operate easily and offer minimum interference to the movement of airplanes. Both straight and curved track types are available. Write for full information and literature

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO
AERONAUTICAL DIVISION
Warehouses and Offices in all Principal Cities

THANK YOU *for mentioning* AVIATION

INSIST UPON THE SIEMENS

And Secure the Benefit of Almost 20 Years' Experience in Aircraft Engine Design

Command-Aire powered with SIEMENS Sh-14

SIEMENS Radial Air-cooled Engines are available in the following power ranges:

Sh-13	5 cyl.	85 h.p.
Sh-14	7 cyl.	110 h.p.
Sh-12	9 cyl.	125 h.p.

Kitty Hawk powered with SIEMENS Sh-14

SIEMENS ENGINES are flown all over the world

Guaranteed Service Through Our Own Service Station, Curtiss Field, Garden City, Long Island

K. G. Frank
Consulting Engineer
75 West Street, New York
General Representative for
Siemens & Halske A. G.

Number Two of a Series of Fact-Statements Regarding a New Industrial Leader—Great Lakes Aircraft Corporation.

Management

AN INSTITUTION is the lengthened shadow of the men responsible for its policies and product. Sound management is the most important single factor in the successful conduct of any business.

Recent announcements regarding important additions to the executive personnel of Great Lakes Aircraft Corporation have more than ever convinced the aviation world of the serious purpose underlying its development. The ability to attract executives of this type is in itself a significant measure of any industrial organization. The broader scope now offered to their respective talents has raised unusual expectations with regard to new vision in design, new quality and performance of product.

The respect which past accomplishment has already won for those comprising the active management of this Corporation will be measurably increased by the results of their current activities in the interest of safe, fast air transportation.

GREAT LAKES AIRCRAFT
CORPORATION — CLEVELAND

Military and Commercial Airplanes - - - Seaplanes and Floats - - Aluminum Alloy Parts

All the facts of construction, maintenance and operation of airplanes, motors, instruments and equipment . . . .

A COLLECTION of facts and suggestions concerning the construction and care of planes, motors and instruments for those interested in modern aircraft. This third edition is a thorough revision.

New Third Edition

AIRCRAFT HANDBOOK

BY FRED H. COLVIN
Editor American Machinist
AND HENRY F. COLVIN

464 pages, 5x8, flexible
134 illustrations, $4.00

THE book contains complete information on the operation and maintenance of standard aircraft engines. This information is authentic as it was prepared in co-operation with the manufacturers of these engines.

The newest developments in aircraft instruments are given the fullest discussion. The Earth Inductor Compass, for example, is given thorough treatment.

The Official Air Regulations of the Department of Commerce have been included, as well as adequate information for those contemplating the construction of airports.

Just a very few of the many hundreds of topics covered in this book.

—stability of airplanes
—keeping the airplane in good condition
—engine design problems
—trouble-shooting on engines
—the Wright Whirlwind engine
—tracing troubles on the Curtiss D-12 engine
—the Pratt and Whitney Wasp
—the Curtiss OX
—Air-speed indicators
—magnetic compasses
—turn indicators
—drift meters
—licensing laws
—airport beacons
—nomenclature
—stresses in wing wiring
—assembling Curtiss JN4's
—tests of propellers
—effect of altitude on engines
—a system of engine inspection
—serving the Wright Whirlwind
—how to check timing on Packard engines without disassembly
—the Liberty engine
—the Wright-Hispano
—altimeters
—inclinometers
—the earth inductor compass
—sextants
—air traffic rules
—seaplane parts and anchorage
—etc. etc. etc.

Fill in and mail this coupon—NOW!

McGRAW-HILL
FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York

You may send me on 10 days approval—Colvin and Colvin's AIRCRAFT HANDBOOK—Third Edition, $4.00 postpaid. I agree to pay for the book or return it postpaid within 10 days of receipt.

Signed
(Please Print)

Address

Official Position

Name of Company

(Books sent on approval to retail purchasers in U. S. and Canada only.) AV 4-20-29

AIRPLANE OPERATORS

INCREASE YOUR PROFITS

Take pictures from the air with the new

FAIRCHILD AERIAL CAMERA

The new Fairchild F-4 "all-purpose" aerial camera accommodates roll film up to 75 feet in length .... enough for 110 exposures 7"x9½". Also standard 8"x10" cut film adapter.

EVERYWHERE today, photographs taken from the air are in demand. Real estate firms need maps of their land ... city governments want towns mapped ... papers and magazines need shots of news interest ... advertisers ... public utilities ... all demand pictures from the air.

And you, an operator, are the logical man to handle this new business. It is an *added* source of income for you. To meet the demand, Fairchild, pioneer builder of aerial cameras, has designed a new camera especially adapted for commercial work and flying schools.

This all-purpose Model F-4 was designed by the same men who built the cameras used by the U. S. Air Service ... the U. S. Navy ... the Royal Canadian Air Service ... Commander Byrd ... the Japanese Government ... and other foreign governments.

It is easy for you to get good pictures. This Model F-4 is fool-proof, simple and positive. This is why experts have selected the Fairchild Camera. The guesswork is out of it. There is no uncertainty.

Aerial photography is fascinating work, and offers another source of revenue for you. There is plenty of room in the field of aerial photography for those who enter it right now.

This is a real expansion for your business and worth your serious attention. Address Fairchild Aerial Camera Corporation, 270 West 38th Street, New York City.

Either vertical or oblique pictures are easy with the manually operated F-4. Focusing mount...pictures 8 feet to infinity Tessar F-4.5 lens. Focal length optional. Price with cut film adapter and vertical suspension mount, only $1,597.

"It all but *flies itself!*"

This is typical of the enthusiastic comments of men who have flown the new Kinner powered American Eagle biplane. And it's true! Here—at last—is a plane which virtually *does* fly itself—a plane which has given a new meaning to the term "stability"!

Dive it to terminal speed with any load—release the controls—and after two or three oscillations it will level itself off perfectly! . . . Pull it into a stall—release the controls—and it will level off with no help from the pilot! . . . Force it into a spin—let it spin as far as you like regardless of load—and it rights itself with no hand on the controls and continues in level flight!

The Kinner powered American Eagle biplane is priced $4595, flyaway Kansas City. It is manufactured under Approved Type Certificate No. 124. We are now offering a most unusual proposition to dealers and distributors. Write to us!

AMERICAN EAGLE AIRCRAFT CORPORATION

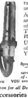
FAIRFAX AIRPORT, KANSAS CITY, KANSAS

Hit the Ceiling Quicker and Oftener!

Start "Upstairs" with the first few turns of the "Prop"!
... Flyers are doing this every day with "Thermo-Pete"

NO longer any need to spend 20 to 60 minutes warming up the cold oil in a colder motor! No more need for removing oil and heating it by hazardous methods! No more need to waste valuable time, valuable fuel, or quickly wear out an expensive airplane motor!

"Thermo Pete" (best friend to motor and pilot) when connected with the ordinary 110-volt lighting circuit, quietly, quickly and inexpensively heats the oil (without injury) to the desired take-off temperature, ready for "Contact" and "Twist the Stick" and "She's Away!"



Approved by National Board of Fire Underwriters and many other authorities, "Thermo-Pete" is today's scientific answer to the need for saving Dollars Pilot's Time Motor Depreciation, Schedule Hours and Hangar Labor.

Use coupon and let us airmail you complete details of the help "Thermo-Pete" will be to the motor of YOUR ship.

Pilots Emory Bronte, Dudley Steele, Phil Salzman and many other well-known flyers, all agree that *"Thermo Pete" saves 75% to 85% of warm up time.* YOU need "Thermo Pete"

Mail Coupon for all Details

Aviation Accessories Corp'n
Balfour Building — San Francisco

I am flying a .... ship
with .... motor
Tell me more about Thermo Pete (A-4 13-29)
Name
Street
City .... State

"PRE-HEAT WITH THERMO-PETE"

It Starts . . .

with a Pull of the Trigger

WHETHER on the ground or in the air—you can always depend on a Heywood for the performance expected of a reliable aircraft starter.

The quality of material used and the precision standards employed in manufacturing meet every requirement for simplicity and lightness of construction. Originally designed for a specific purpose and constantly improved and refined—today, the Heywood Starter combines every advanced feature for your safety and comfort. Truly, a Heywood Aircraft Starter brings to you the carefree convenience of your own automobile.

The most exacting pilots and manufacturers are enthusiastic in their unqualified endorsement of this dependable unit.

The Heywood Starter trigger, located on dash, releases compressed air that rotates engine at required speed and injects a carbureted mixture into the cylinders in firing order. It is an unfailing starting device under all weather conditions.

Complete details and installation data sent on request. Give make and model of engine.

THE HEYWOOD STARTER CORP.
6547 St. Paul Ave. Detroit, Mich., U.S.A.

SAFE DEPENDABLE — *POSITIVE CONVENIENT*

HEYWOOD self STARTER

Some One Wants To Buy

the equipment or machinery that you are not using. This may be occupying valuable space, collecting dust, rust and hard knocks in your shops and yards.

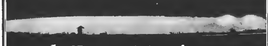
Sell it

before depreciation scraps it.

The Searchlight Section is helping others— Let it help you also

6867

WICHITA *LIGHTS UP*



with B. B. T. *of course*

Wichita, one of America's major Airdromes, and a Transcontinental Port of Call, realizes that even, intense illumination over its entire usable landing area is necessary to insure Happy Landings and Take Offs after dark. To insure this condition, they naturally chose—

AVIATION'S BAD WEATHER FLOODLIGHTS

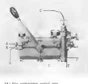
Different types of B B T FLOODLIGHTS are available for every airport, large or small.

B·B·T CORPORATION OF AMERICA
ATLANTIC BUILDING
PHILADELPHIA

Write for our latest catalogue, illustrating various types of "SAFE AIRPORT LIGHTING"

COCKPIT ENGINE STARTER

The only one in the World, allowing the pilot, without effort and by the sole means of the apparatus that there is on board, to repeatedly start (successively or at several days interval) one or several motors of any power, and by all temperatures, without touching the propeller.



(A) Fire extinguisher control pipe
(B) Fire extinguisher air tank pipe
(C) Pipe carrying mixture Combustion chamber
(D) Connection of air tank of engine starter
(E) Gasoline inlet tube
(F) Injection pipe
(G) Tire inflation pipe

ITS ADVANTAGES:

Self turning gasoline engine-starter, turning the motor to find a good flash point.

Special setting for all temperatures from —40 to +140, Including, 1 distributor by motor, 1 standard starter for all types of aircraft whatever the power and number of motors may be

USED FOR:

The starting of motors of all powers.
The injection of gasoline into the inlet pipes.
The compressed air for fire extinguishers.
The compressed air for oleopneumatic landing gears.
The compressed air for pneumatic wheel brakes
The compressed air for tire
The compressed air for pneumatic rescue equipment.
It's the lightest and cheapest engine starter, having the greatest number of usages.

P. VIET, *Factory:* 64 Avenue Edouard-Vaillant—BILLANCOURT, (Seine) FRANCE

To Pass the

TRANSPORT PILOT'S EXAMINATION

you must know

Navigation and Meteorology

A book has been prepared which thoroughly covers the examination for any grade of license in these subjects, and if the candidate will spend a few hours studying it no difficulty will be experienced.

$2.50 Postpaid

Mail Order to:

Captain Lewis A. Yancey
427 West End Ave., New York City

CAPTAIN LEWIS A. YANCEY
427 West End Ave.
New York City

Enclosed please find check for $2.50 for which send me copy of *Aerial Navigation and Meteorology.*

NAME ....

ADDRESS ....

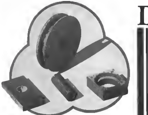
CITY .... STATE ....

Distinctively different are the interiors of cabin planes upholstered with "AEROVEL", a group of mohair fabrics especially adaptable to the increasing vogue for beauty in cabin interiors. Samples of "AEROVEL" upon request.

The Shelton Looms

Aeroplane Fabrics Division

One Park Avenue New York



Bakelite Laminated parts used on airplanes made by Consolidated Aircraft Corporation Buffalo N Y

Bakelite Laminated— for airplane parts—Light— Strong—Non-corrosive

VITAL parts of the standard training planes for both the Army and the Navy are made of Bakelite Laminated. Cable pulleys and guides and wing spar bearing spools must be light but very strong, must resist erosion and corrosion and be non absorbent. For all of these parts Bakelite Laminated has replaced other materials

On these same planes the engine mount shims are of Bakelite Laminated because it is not affected by gasoline or oil, and is non-hygroscopic The properties that make Bakelite Laminated so valuable a material for airplane parts, make it equally desirable for many automotive applications.

Bakelite Laminated is available in sheets, tubes and rods and is sold under the following trade-names

FIBROC PHENOLITE SPAULDING BAKELITE
FORMICA Micarta Textolite Dilecto

Manufacturers are invited to enlist the Cooperation of Bakelite Engineering Service

BAKELITE CORPORATION
247 Park Avenue New York, N Y
Chicago Office 635 W 22nd Street
BAKELITE CORP OF CANADA, LTD
163 Dufferin Street Toronto Ontario

BAKELITE

THE MATERIAL OF A THOUSAND USES

DO THIS
and you will obtain the best HANGAR and SAVE MONEY

THE many types, problems involved and claims made for Hangars, makes it essential to obtain reliable information—information that will result in an economical and satisfactory Hangar to you

For instance, certain types cost many thousands of dollars, are impractically constructed for your constantly changing needs, and will not meet your requirements as efficiently as a far lower-priced, sturdy and scientifically designed steel Hangar

These and many other important considerations should be known and considered before your decision is made

ESLINE are pioneers in STEEL BUILDINGS construction and are ready to supply you with all the important information and literature that you should have Our engineering department is ready to meet your particular problems—all this without obligation to you

ESLINE HANGARS are reasonable most practical and are sold on convenient terms

Write for Our Descriptive Literature

ATTRACTIVE DEALERS PROPOSITION OPEN TO YOU FOR FIRST HANGAR IN YOUR TERRITORY

ESLINE CO.
DEPT A
OCONOMOWOC, WISCONSIN

Esline Co. Dept A Oconomowoc Wisconsin
Please send information on Hangar size

Name

Address

"deserves a place in every designing office . . . ."
The Aircraft Engineer —England

THIS book has been hailed everywhere as a classic in its field. It is the first volume of a series on airplane design, and discusses aerodynamics in detail, thoroughly, authoritatively.

Airplane Design AERODYNAMICS

THE object of [illegible] the requirements of airplane design, though the topics treated are not uniformly characterized by immediate availability of practical application. Matter of abstract or academic interest is introduced only where it will round out the picture of aerodynamic development not as a group of disconnected results of disconnected tests but in the aggregate. The discussion is detailed and complete, covering in logical sequence every phase from nomenclature to controls and controllability, maneuverability and spinning.

By EDWARD P. WARNER

Professor of Aeronautical Engineering, Massachusetts Institute of Technology; [illegible] Assistant Secretary of the Navy for Aeronautics

600 pages, 6 x 9, 333 illustrations, $7.50

Some of the topics discussed

—types of aircraft (Page 3)
—dimensions of wing and wing combinations (Page 12)
—fluid resistance (Page 19)
—pressure distribution plotting (Page 40)
—effects of varying upper camber (Page 67)
—calculation of downwash (Page 93)
—shaping of wing tips (Page 102)
—deology (Page 111)
—biplane interference (Page 125)
—center of pressure on tandem combinations (Page 129)
—slotted wings (Page 144)
—Saturnary effect (Page 159)
—skin friction (Page 18[illegible])
—shielding and fairing of round wires (Page 210)
—fuselages (Page 221)
—air density and power output (Page 239)
—rate of climb (Page 269)
—air resistance to taking off (Page 2[illegible])
—performance prediction from wind tunnel tests (Page 229)
—tail efficiency (Page 343)
—eccentricity of propeller thrust (Page 361)
—locked control stability (Page 371)
—spiral stability (Page 425)
—hinge moments and yawing moments (Page 460)
—turning without side slip (Page [illegible])
—looping and pulling out from dives (Page 526)
—calculations on post stabilization (Page 542)
—general theory of spinning (Page 5[illegible])
—damping of yaw (Page 588)

Send for the book itself for 10 days free examination. You will not be annoyed by stepping follow-ups, agents, salesmen or red tape. You merely agree to return the book, postage prepaid, in 10 days or to send us $7.50 as payment in full at that time.

See it FREE—Send just the coupon.

McGRAW-HILL
FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York
You may send me on 10 days approval WARNER'S AERODYNAMICS [illegible] in books. I agree to remit for the book or to return it postpaid within 10 days of receipt. (To secure book on approval write plainly and fill in all lines.)

Name

Home Address

City and State

Name of Company

Occupation

(Books sent on approval to retail purchasers in U. S. and Canada only.)
A [illegible]

7 Miles Up 76° Below with G-E Superchargers

AT a height of 37,854 feet—more than seven miles above the earth—two War Department aviators, Captain Street and Captain Stevens, established a record for aerial photography by obtaining a photograph covering 30 square miles of territory. The temperature on the ground at take-off was 71 degrees above zero F., and at the maximum height was 76 degrees below.

General Electric superchargers—one of which made this record possible—are making a big contribution to the safety and success of flying. That's why practically all leading airplane-engine builders use them as standard equipment.

321-25

GENERAL ELECTRIC
General Electric Co., Schenectady, N. Y., Sales Offices in Principal Cities

"How To Use Aviation Insurance Protection Economically and Advantageously"

Insurance Protection Available
aggregates over $1,000,000 per aircraft
Constructive total loss
Accidental Damage
Fire, Tornado, Theft
Cargo (direct and liability)
Damage to ground property
Airport and Airmeet liability
Life insurance
Public liability
Property Damage
Passenger liability
Personal Accident
Compensation
and
other forms constructed as required

An Open Market
to all Insurance Companies, Reinsurers, Agents and Brokers. Standard conditions extended to meet special requirements.

. . . . Is the title of our informative brochure. Ask us for a copy. It explains also our free advisory service founded on 20 consecutive years' practical experience in aviation and supported by our corps of highly qualified aeronautical engineers and our staff of executives, each one of broad practical experience in flying besides long training in insurance.

GOOD SERVICE COUNTS

More aviation claims paid by our organization than by all other organizations throughout the world.

Lowest Rates-Broadest Coverage-Highest Indemnities-Quickest Service

Policies have been issued over a long period of years and among others in favor of Federal and State Governments, Boeing Air Transport, Colonial Air Transport, Colonial Western Airways, National Air Transport, Western Air Express, Northwest Airways, Walter T. Varney Inc., Universal Aviation Corporation, Scull Air Services, Philadelphia Rapid Transit, Boston Airport Corporation, American Railway Express, Ford Motor Company, Fairchild Flying Corporation, Pitcairn Aviation Inc., Standard Oil Companies of New York, New Jersey, Louisiana and California, Shell Petroleum Corporation, Tidewater Oil Company, United Cigar Stores Inc., Royal Typewriter Company, Pullman and other race meetings, Universal Motion Picture Corporation, Fox Film Corporation, Atlantic Aircraft Corporation, Bellanca Aircraft Corporation, Chance Vought Corporation, Lockheed Aircraft Corporation, Moth Aircraft Corporation, Pratt & Whitney, Sikorsky Aviation Corporation, Stinson Aircraft Corporation, Thompson Aeronautical Corporation, Goodyear Tire & Rubber Company, International Telephone & Telegraph Company, Radiomarine Corporation of America, Westinghouse Electric & Mfg. Company, California Standard Finance Corporation, Canadian Transcontinental Airways Ltd., Western Canada Airways Ltd., S. C. A. D. T. A. of Colombia S. A., Andian National Corporation of Colombia S. A., Maddux Air Lines, Transcontinental Air Transport, The Daniel Guggenheim Fund for the Promotion of Aeronautics, North American Newspaper Alliance, and many others, including Col. Charles A. Lindbergh, Sir Hubert Wilkins, Anthony Fokker, Lady Mary Heath, Miss Amelia Earhart and other leaders in aviation.

BARBER & BALDWIN, Inc., Graybar Bldg., New York City, *Tel.* Lexington 4316
Underwriting Agents for All-American Insurers and Reinsurers

20 YEARS OF PRACTICAL EXPERIENCE IN AVIATION

USE THE AIR SERVICE

Airports and Aviation Buildings by Austin

COMPLETE *Airport Service*—preliminary surveys and reports, engineering surveys and studies, site selection.

Design and Construction—grading, drainage, lighting, all necessary airport buildings such as hangars, depots, etc. Also aircraft factory buildings.

Ask for approximate costs and booklet "Airports and Aviation Buildings."

THE AUSTIN COMPANY
Airport Engineers and Builders CLEVELAND
New York, Chicago, Philadelphia, Detroit, Cincinnati, Pittsburgh
St. Louis, Seattle, Portland, Los Angeles, San Francisco, Dallas

HALL-ALUMINUM

AIRCRAFT CORPORATION

Strong, Light Weight

ALL-METAL

Airplanes, Seaplanes, Flying Boats and Floats

Standardized Drawn Sections and Stamped Parts Adaptable to Your Present Designs or New Designs Supplied

2050 ELMWOOD AVENUE
BUFFALO, NEW YORK
Contractors to U. S. Navy

FLY AWAY JACK,
FLY AWAY JILL
THE "HALLOWELL" BENCH
STANDS PERFECTLY STILL

Pat'd and Pats. Pending

"Hallowell"
Steel Work-Bench

Steel is being used more and more in all walks of life because it won't splinter, crack, warp, get wobbly, absorb oil and burn—as wood does.

The "HOLLOWELL" Steel Work-Bench is a fine example of modern Steel Shop Equipment—strong, rigid, wobble and fire-proof; wears and lasts as only steel can.

The picture shows an individual bench; we also make continuous benches, by the foot, by the mile, if need be; standard sections bolted together and easy to take apart and rearrange—this is impossible to do with wooden benches.

We carry 1368 combinations of "HALLOWELL" Steel Bench Equipment in stock for immediate shipment.

"HALLOWELL" CONTINUOUS STEEL BENCH

Write for Bulletin 386

STANDARD PRESSED STEEL CO.
Jenkintown, Pa., Box 528
BRANCHES CARRYING STOCK

26 N Clinton St, Chicago Ill — 800 So 4th St., St. Louis, Mo. — 944 Harper Ave., Detroit, Mich.

In the NATIONAL AIR RACES, September, 1928,
B. G. MICA SPARK PLUGS
again showed their absolute
Reliability of Performance

The Transcontinental Races, Classes, A, B and C 1st, 2nd and 3rd places

All the Closed Course Events with air-cooled Whirlwind and Wasp engines.
11 out of 11—1st place
11 out of 11—2nd place
8 out of 9—3rd place

The Mitchell Trophy Race Curtiss D-12 engines—1st and 2nd places

The Mason M. Patrick Trophy Race Curtiss D-12 engines—1st, 2nd and 3rd places.

ALL WHIRLWIND, WASPS AND HORNETS IN THE TRANSCONTINENTAL NON-STOP RACE WERE EQUIPPED WITH B G MICA SPARK PLUGS

Actual size of the B. G. "Hornet"

The BG Corporation

136 WEST 52nd STREET, NEW YORK, N Y.

STRENGTH

THE actual structural strength of these wheels is far in excess of the requirements of the official hand books or of the ability of the tires used to stand, thus increasing the FACTOR OF SAFETY at a vital point. This with decreased weight.

Bendix Wheels and Brakes are now in production in standard sizes.

(Fully protected by patents and applications in U. S. and abroad)

BENDIX BRAKE COMPANY
General Offices and Plants South Bend, Ind.
Division of Bendix Corporation, Chicago

BENDIX (4) BRAKES
FOR SAFETY

AVOID *the* HAZARD *of* Broken Glass

For body enclosures and windshields use

AMERICAN LAMINATED

Non-Scatterable Clear Flat Glass. All weights, sizes and shapes to specification.

▼ ▼ ▼

Where weight counts most use

AMERICAN
"Feather Weight"

Made from the finest photo glass.
Inquiries are solicited.

AMERICAN WINDOW GLASS COMPANY
General Offices
Farmers Bank Bldg., Pittsburgh, Pa.
Sales Offices in Principal Cities

Looking Into an Airport's Future Aviation is such a young industry, and such a fast moving one, that it is difficult to predict developments in the next five or ten years. Every transportation terminal presents its own problem. Each airport requires individual thought and study, particularly to reduce investment to a minimum, when you consider that what is modern today may be inadequate or obsolete ten years from now. We invite your inquiry if you are interested in airports, airport buildings and aviation factories.

AIRPORT DEVELOPMENT AND CONSTRUCTION COMPANY
1020 MITTEN BUILDING PHILADELPHIA

EDO
THE FLOAT MAKERS

EDO converts land planes into seaplanes by furnishing complete float installation, which is interchangeable with the wheel landing gear. Its installations are approved by the Department of Commerce. Complete seaplanes incorporating EDO equipment can also be purchased direct from the leading airplane manufacturers. May we send particulars?

EDO AIRCRAFT CORP. 600 Second St., College Point, L. I.

There's No Question About It!
—The Record Breaking

"QUESTION MARK"
Used
AIRCRAFT SCREW PRODUCTS
Manufactured by The

AERO SUPPLY MFG. CO., INC.

Dependability means safety

OUR CREED
MAKE IT SAFE FOR THE FLYERS THE WORLD OVER

Write The
Aero Supply Mfg. Co., Inc.
College Point, L. I.
For Catalog on Airplane Screw Products, Accessories and Aeronautical Supplies

KITTY HAWK

Flies Like a Hawk—Lands Like a Kitten

WE THANK all you pilots who have flown KITTY HAWKS. First, for the praise you have given our ship and secondly, for the suggestions you have made. All of these have been carefully considered and many have been incorporated in KITTY HAWK development. The ship comes to the market today as the pilot's designed plane.

BOURDON AIRCRAFT CORP.
Hillsgrove, R. I.

the ideal HANGAR for airplanes

NO COLUMNS

NO TRUSSES

Arch Roof Construction offers the perfect building for all hangars, temporary or permanent. It gives perfect light and ventilation and is the most economical to erect. Spans up to 200 feet and over.

Further information on request. Our service department will co-operate with engineers contractors and all others interested.

ARCH ROOF CONSTRUCTION CO., INC.
104 West 42nd St. — New York City
Engineers and Contractors

WANTED—4,000 AVIATORS

There will be a shortage of properly trained pilots to fly the thousands of airplanes now being produced. W-I-L Air School is sending a steady stream of crack pilots to fill the Commercial World's demands. YOU CAN BE ONE OF THEM!

The World of Commerce is crying for pilots to man the fleets of planes turned out monthly, weekly.

BIG SALARIES AWAIT CRACK PILOTS— WILL YOU BE ONE?

Let W-I-L Airschool make you a commercial pilot fit you for the big jobs that are awaiting trained aviators. Centrally located in the heart of one of the World's Greatest Industrial Areas, W-I-L Airschool is ready to give you the maximum of training with the most modern equipment obtainable. Instructors among the nation's best, will teach you every phase of flying and ground work. AND you can EARN PART OF YOUR TUITION! Write for our offer TODAY!

W-I-L Air School, Inc.

MELBOURNE HOTEL
ST. LOUIS, MO.
AIRPORT—
GRANITE CITY, ILL.

FLEXIBLE STEEL WIRE SHAFTS

for power transmission around corners and over obstacles — silent, steady durable, strong.

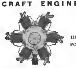
The S.S.White Dental Mfg. Co.
Industrial Division
152 West 42nd St. New York, N.Y.

S.S.WHITE FLEXIBLE SHAFTS

Write for this book. Sent free on request.

BROWNBACK AIRCRAFT ENGINES

MODEL C-400 — 90 HORSE POWER



BROWNBACK MOTOR LABORATORIES, Inc.
Office—Graybar Building, New York City Factory—Pottstown, Pa.

G&O Radiators for AIRCRAFT

EFFICIENT
LIGHT WEIGHT
DEPENDABLE

The G&O Mfg. Co. New Haven, Conn.

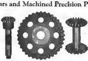
Have you seen:

THE 21 — two-passenger open
THE 41 — four-passenger cabin
THE 71 — seven-passenger cabin

FAIRCHILD AIRPLANES

HIGH GRADE

Gears and Machined Precision Parts



INDIANAPOLIS TOOL & MFG. COMPANY
INDIANAPOLIS INDIANA

Aircraft Forgings

"We are pioneers in the manufacture of aircraft and automotive forgings." Send us your inquiries.

For many years *Endicott* has made forgings for the aircraft industry that have met the intricate demands of the manufacturers. "The Forging People Who Satisfy" will be very pleased to offer advice and help you work out your forging problems.

THE ENDICOTT FORGING & MFG. CO., Inc.
ENDICOTT, N. Y.

ENDICOTT DROP FORGINGS

AIR-COOLED CYLINDERS Made by Experts

The casting of air-cooled cylinders is not an ordinary job that you can safely farm out to the nearest foundry but a specialized process requiring for best results years of careful study and development.

Our organization has been making air-cooled cylinders for 25 years and can give you the expert specialized service you need.

If desired we can make patterns to your blue prints, and can machine cylinders to your specifications.

AIR-COOLED

S.Cheney and Son
MANLIUS, N.Y.

With increased production of

SUMMERILL Tubing

Quality is maintained

SUMMERILL TUBING COMPANY
Bridgeport, Montgomery County, Pennsylvania
(PHILADELPHIA DISTRICT)

SEAMLESS STEEL TUBING

All Aircraft Grades

WAREHOUSE STOCKS for immediate shipment in any quantity.
MILL SHIPMENTS for substantial production requirements.

SERVICE STEEL COMPANY
1435 FRANKLIN STREET
DETROIT

347 Ellicott Sq. BUFFALO	32 E. Front St. CINCINNATI	214 N. Alameda St. LOS ANGELES

All

Aeronautical Supplies

The largest stock of aeronautical supplies, parts and accessories—everything from propellor to tail skid, from goggles to moccasins.

Write for your copy of Catalogue F.

Nicholas-Beazley Airplane Company Inc.
Marshall — Missouri

SAFETY AIRCRAFT TIMM 1911

TIMM AIRPLANE CORP.
901 N. San Fernando Rd.
Glendale, Calif.

The SIKORSKY is the only twin-engined omphibion thot can climb ond fly on one engine

Curtiss Flying Service, Inc.

New York Office—GARDEN CITY, L. I.

Sole Sales Agents for SIKORSKY AVIATION CORP.

"—world's oldest flying organization"

WOULD YOU ASK FOR MORE THAN THIS?

Lieut. Flo wearing Aerotogs

I can honestly say that Aerotogs are the warmest and most comfortable flying clothes I have ever worn. I have found that after seven or eight hours of continuous flight, a flying suit becomes almost unbearable if it offers the slightest discomfort. The fact that the Aerotogs suit did not cause the slightest discomfort throughout the whole flight proves the extreme soundness of its design. Also the extreme ease with which it is possible to get in and out of Aerotogs is another point in their favor. Flying into a very warm climate in Florida it was necessary to remove the suit. Removing a heavy winter flying suit while flying an open cockpit plane is usually quite difficult. I experienced no difficulty in taking off the Aerotogs suit. Another thing I like is the accessibility which makes it possible to adjust inner clothing.

LEONARD FLO

Lieut. Flo is referring to a non-stop solo flight from Canada to Key West, Florida. In addition to an Aerotogs flying suit he wore an Aerotogs helmet and Aerotogs mittens. Such satisfaction as his has made Aerotogs popular with men like Commander Byrd, W. A. Mara, Eddie Stinson, and "Speed" Holman. If your dealer cannot supply Aerotogs write to us. **Gordon & Ferguson, Inc., St. Paul, Minn.**

Gordon
AEROTOGS

PROMPT DELIVERY! Increased Production Facilities make possible IMMEDIATE DELIVERY

SUPREME PROPELLERS INSURE not only Supreme Performance BUT Supreme Service. Manufactured since 1908 by STONE PROPELLER CO.

ON March 18 the Department of Commerce issued its weighty Certificate of Approval designating the Supreme Propeller as Design No. 750. This endorsement added to the previous high standing of the Supreme Product should guide you in deciding on propellers.

SUPREME PROPELLER CO.

WICHITA, KANSAS

STONE PROPELLER CO.

Territory available for reliable dealers

SITKA SPRUCE

All clear selected grain for Aircraft. Spars and rib stock ready for immediate shipment —all sizes—all lengths. Send your list for immediate quotation. Small express shipments made same day order is received. Our complete planing mill can run special sizes quick.

YOHO & HOOKER LUMBER CO.

Aircraft Department

240 Wing Building, Youngstown, Ohio

Aviation Protection, Inc.
Insurance Brokers to Aviation

110 William Street
New York City
Telephone: Beekman 8184-8185

MOTORS
HISSO, OX5 and LIBERTY

180 hp. HISSO MOTORS. Guaranteed A-1 condition. New pistons, rings, wrist pins and Zenith carburetors. Ready to install and use. Each $1200.

150 hp. HISSO MOTORS. Conditioned same as 180s. $1000.

OX5s. Reconditioned throughout. Will turn 1425 on the ground. Ready to install. Will guarantee. $400 to $600.

EVERY motor we sell has been completely torn down and properly conditioned. New parts have been installed where needed. Most of the Hissos have had less than 25 hours since they were brand new. All in perfect condition. They are offered complete with oil scavenger pumps, magnetos, new Zenith carburetors, etc. These motors can be inspected if desired. Write or Wire.

MASSACHUSETTS AIRWAYS CORP.

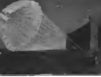
1562 Main St., Suite 608, SPRINGFIELD, MASS.

"For Safety in the Air, — Everywhere"

No detail of the

IRVING AIR CHUTE

has been left merely to theory,—superiority of every feature proved through years of severe service use and by thousands of comparative tests. Used by all Air Forces of the United States, Great Britain and 27 other Governments.



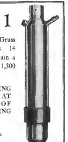
OVER 100 LIVES SAVED IN EMERGENCY
OVER 8,000 SUCCESSFUL "LIVE" DROPS
OVER 30,000 SUCCESSFUL TEST DROPS

Illustrated literature on request

IRVING AIR CHUTE COMPANY, Inc.
372 Pearl Street — Buffalo, N. Y.

Cable Address: "Irvin Buffalo, N. Y., U. S. A."

92.8 *to* 1



A pair of two inch Gruss Air Struts weighs 14 pounds. It will sustain a static load of 1,300 pounds.

OUR ENGINEERING DEPARTMENT IS AT THE SERVICE OF ANYONE DESIRING INFORMATION

Aeronautical Division

GRŪSS

Air Spring Company of America

220 Ninth St., San Francisco, Calif.

Acetate Nitrate — Clear Pigmented

PERRY-AUSTEN
DOPES

Perry-Austen Clear Acetate Dope

The Lasting Undercoat

The Best Finish { Undercoats—Our Clear Acetate; Uppercoats—Our Pigmented Dopes

PERRY-AUSTEN MFG. CO.

Contractors to United States Government

Main Office and Works: Grasmere, Staten Island, N. Y.

Tel: Dongan Hills 707

Chicago: 510 N. Dearborn St. — Tel: Superior 6948

RUSCO
AERO PRODUCTS

Safety Belts... Aero Rings... Aero Cords... Shock-Absorber Units... *'Grade A'* Aero Cloth, in all widths... Tapes... Braids... Lacings... Webbings... Tail-Skid Boots... Tank Straps... Battery Covers ... Brake-Linings ... Miscellaneous Textile, Leather and Stranded Rubber products.

Write for Complete Aero Catalogue

The RUSSELL Manufacturing Co.

Aeronautical Division — Sales and Engineering Offices

349 BROADWAY — NEW YORK CITY

Cunningham-Hall Airplanes

All-metal structure — insures durability, lower maintenance and greater safety.

Manufactured by

CUNNINGHAM-HALL AIRCRAFT CORPORATION

13 Canal St.

ROCHESTER, NEW YORK

KNOW THESE NAMES?

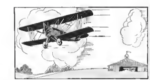
W. W. Moss	*President*
Henry Berliner	*V. P., Construction and Production*
Temple N. Joyce	*V. P., Sales and Military Development*
Frank S. Hubbard	*Chief Engineer*
William Wait, Jr.	*Chief of Design*
William H. Miller	*Research Engineer*
Earl P. Osborn	*Engineer of Structures*
Thomas E. Pell	*Factory Superintendent*

Executive and Engineering Staff of the new

BERLINER-JOYCE
AIRCRAFT CORPORATION

OFFICES Hearst Tower Building, BALTIMORE, MD.

Present factory, Alexandria, Va.
New factory building at Baltimore Airport



Take Off in a Challenger
. . . Give Her the Gun

Climb a few thousand feet—nose down a little—give her the gun as you level off. Zoom, barrel roll, loop, throttle way down to slow speed. Put a Challenger through the works, Mr. Pilot. You'll see in your first few minutes in the air why Challenger Planes are so popular with the men who fly.

Ease of control—climbability—slow, safe landings in the smallest fields. These are but few of the features marking Challenger leaderships even to the man who has never touched a stick. Passengers, too, everywhere are requesting their rides in Challenger Planes.

Draw the paying rides to your field with Challenger Planes.

KREIDER-REISNER AIRCRAFT COMPANY
Hagerstown, Maryland

Write for Booklet

The Challenger

HAMILTON PROPELLERS ARE USED THE WORLD OVER

HAMILTON PROPELLERS

Hamilton Aero Mfg. Co., 60 Keefe Ave., Milwaukee, Wis.

COLONIAL GRAIN UPHOLSTERY LEATHER
made by
EAGLE-OTTAWA LEATHER COMPANY
Grand Haven, Mich.

Genuine leather for airplanes is NON-INFLAMMABLE, durable and clean.

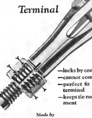
Genuine leather is sound proof and vibration absorbing

Sample books furnished on application

Chicago Ill. 912 W. Washington Blvd.	New York City 74 Gold St.
St. Louis Mo. 1800 Locust St.	San Francisco, Calif. 568 Howard St.

AVIATION
April 20, 1929

MACWHYTE
SAFE-LOCK
Terminal



—locks by compression
—cannot come loose
—perfect fit for every terminal
—keeps tie rod in alignment

Made by
Macwhyte Company, 2905 Fourteenth Ave., Kenosha, Wisconsin
Makers of
Streamline and Round
TIE RODS

SER-O-PLY
SERUM SEALED PLY-WOOD

AIR CRAFT PLYWOOD
manufactured with
BLOOD ALBUMEN WATER-PROOF GLUE
The Carrom Co.
Established 1889
LUDINGTON-MICHIGAN

SER-O-PLY is manufactured by an experienced organization with plants fully equipped with modern wood working machinery—200,000 square feet of floor space

Send us your specifications covering

— AIRCRAFT PLYWOOD
— PLYWOOD BOX BEAMS
— AIRCRAFT PLYWOOD FURNITURE
— CABINET WORK
— FABRICATED AIR CRAFT WOOD PARTS
— WING RIBS

PROTECTION

CONSOLIDATED INSTRUMENTS

CONSOLIDATED INSTRUMENT CO. OF AMERICA, Inc.

Standard Sizes For Department of Commerce Class "A"-"B"-"C" Airports

Easily, quickly, and economically erected—Sectional units bolted together on the field assure easy dismantling and moving—Sturdy arch construction with substantial doors—Ample side space for office, shop or storage—Toncan iron or sheathing and slate coated roof—Non-breakable celo-glass windows

Save a third—Write for bulletin.

NO-TRUS HANGAR CORP.
Home Office: Esperson Bldg., Houston, Tex.
Eastern Office: 140 Cedar St., New York, N. Y.

FLY A
CAVALIER

STAND HER ON THE PROP AND

establish a gauge by which you can measure the performance and stability of other good airplanes . . . The nearest dealer will gladly afford you this opportunity.

Star Aircraft Co.
BARTLESVILLE, OKLAHOMA

PITCAIRN AIRCRAFT

For Air Mail use . . . . SUPER MAILWING

For Sport or Private use . . SPORT MAILWING

PITCAIRN AIRCRAFT, Inc.
Bryn Athyn, Penna.

PARKER TUBE COUPLINGS

Perfectly tight metal to metal joints of maximum strength and resistance to vibration, with minimum bulk and simplicity of design, are essential for modern aircraft.

Every modern ship carries PARKER TUBE COUPLINGS—they are available in brass or aluminum alloy and in innumerable shapes and sizes.

SEND FOR LITERATURE

P-418

The PARKER APPLIANCE Co.
10320 BEREA RD., CLEVELAND, OHIO, U. S. A.

TITANINE
Registered Trade Mark
A Complete Range of
AIRPLANE FINISHING MATERIALS

Dope-proof paint, black, white, aluminum or grey;
Clear nitrate and acetate dopes;
Ti-Two colored one-material dope,
Pigmented nitrate dopes;
Flexible wing lacquer;
Wood and metal lacquer (for inside and outside finish)

TITANINE, Inc.
Union, Union County, New Jersey
Contractors to the United States Government

A complete motor overhaul service

TAC

WE offer pilots and transport companies the most modern repair and overhaul service in the middle west. All motors. Wrights a specialty. Veteran mechanics. Rebuilt motors run in and block tested 10 hours. We stake our reputation on every job. Inspection and estimate gladly furnished. Use our hangar as your Cleveland service station.

(Stinson Dist. Ohio, Mich., western Penna.)

Thompson Aeronautical Corp.
CLEVELAND AIRPORT

AIRWORTHY

Airworthiness is always associated, in the minds of experienced pilots, with the Swallow. Because Swallow, America's pioneer builders of commercial aircraft, has never had a structural failure in the air, in all the years Swallows have been in daily service.

Even under the hardest kind of service, Swallows stand up—delivering more hours of trouble-free service, year after year, than any other commercial plane.

The new Swallow T-P, Approved Type Certificate No. 165—built for student training, is the ideal low priced ship for this purpose. Write for full details.

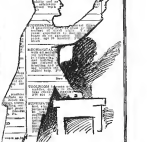
SWALLOW AIRPLANE CO.
WICHITA, KANSAS

Aluminum Fuel and Oil Tanks

"Tank up with the leaders"

Lightest aluminum welded tank per gallon —most durable— highest safety factor. Prices in range with commercial aviation.

Streloff-Naughton
CORPORATION
50 Williams Street, Long Island City, N. Y.
Telephone Hunters Point 10463



"SEARCHLIGHT" Want ads Talk—

They go direct to those in the industry you wish to reach and tell your story in a forceful and business-like way.

They don't mince words but get right to the point

Use them for—

Agencies Wanted	Industrial Sites
Agents Wanted	Labor Bureaus
Auction Notices	Machine Shops
Bids Wanted	New Industries Wanted
Books and Periodicals	Partners Wanted
Buildings For Sale	Patent Attorneys
Business Opportunities	Patents For Sale
Civil Service Opportunities	Plants For Sale
Contracts to be Let	Positions Vacant
Contracts Wanted	Positions Wanted
Desk Room For Rent	Proposals
Desk Room Wanted	Property For Sale
Educational	Receivers' Sales
Employment Agencies	Representatives Wanted
Foreign Business	Salesmen Wanted
For Exchange	Specialties
For Rent	Sub-Contracts Wanted
Franchises	Water Front Property
Help Wanted	Work Wanted

Miscellaneous for Sale for Rent or Want Ads

For Every Business Want
"Think SEARCHLIGHT First"

6144

W H E R E T O F L Y

California

PACIFIC TECHNICAL UNIVERSITY
SAN DIEGO CALIF.
HOME STUDY COURSES
IN
AIRPLANE DRAFTING
WEEMS SYSTEM OF NAVIGATION
AIRPORT MANAGEMENT
AERONAUTICAL ENGINEERING
GROUND SCHOOL OF AERONAUTICS
PRACTICAL SHOP WORK
FLIGHT INSTRUCTION
Affiliated with T. C. Ryan Flying School
Write for Catalog

California

LEARN AVIATION with RYAN

The ONE School that gives COMPLETE quality training. Specializing in long, thoro Ground & Air courses producing experts and commercial pilots. San Diego has perfect flying weather year 'round. Greatest continuous flying activities of any city in the United States.

T. C. RYAN FLYING SCHOOL

3300 BARNETT AVENUE SAN DIEGO CALIF.

California

Western College of Aeronautics
154 W. Slauson Ave. Los Angeles Calif.
One of the finest technical and practical air courses in the world
Engineering Designing Flying
The Western Course equips you for positions of executive capacity
Licensed Pilots
Send for catalog

Illinois

Learn to Fly at a Midwest Airways Corporation School

Under the direction of John H. Livingston

Three large Airports in the central west—at Aurora, Ill. Monmouth, Ill. and Waterloo Iowa.
We are training students to fly because we need pilots for the planes we sell
Largest distributors of commercial aircraft in the central states.

Midwest Airways Corporation
Waco and Ryan Distributors

Illinois

Only 50 miles west of Chicago
Eagle Airport School of Aviation
Herman J. Neubauer M.D.
Hinckley Illinois
Learn to Fly at our up-to-date school at very reasonable prices. Complete ground and air course. Come any time. Ideal accommodations for students. Expert instructors. Write for information

Illinois

A College of Aeronautics
OFFERING
The most complete flight and ground training available
Write for School Catalog
ILLINOIS-IOWA AIRWAYS, INC
Rock Island Illinois

Illinois

UNIVERSAL AVIATION SCHOOLS
EGYPTIAN FLYING SCHOOL
Marion Airport Marion, Ill.
one of the
Universal Aviation Schools

Kansas

UNIVERSAL AVIATION SCHOOLS
Universal Flying School
Fairfax Field Kansas City Kansas
one of the
Universal Aviation Schools

Massachusetts

LEARN TO FLY IN NEW PLANES
Under the direction of 3 well known pilots. 10 hour course including solo. 50 hour rating LIMITED Commercial. 200 hour course TRANSPORT. We also cater to those who have soloed and need only Solo Time with occasional check ups. Further information on application. Distributors in New England for Ryan Monoplanes
Massachusetts Airways Corporation
Springfield Mass.

Maryland

Learn to Fly in Modern Planes at
TRED AVON FLYING SERVICE, INC.
Easton, Maryland
THE PERFECT FLYING COUNTRY
Complete 10 hour course including solo and ground course, $400.00
10 and 50 hour solo courses at reasonable rates
Board and lodging near field for $10.00 a week.
Write for Details

Maryland

LEARN TO FLY
At the largest and most modern equipped airport in the east, where flying conditions are ideal all year around. Instructions under personal supervision of licensed transport pilots on New American Eagle Planes, with OX and Radial motors. Students may obtain room and board on the field or within walking distance. Del-Mar-Va's Flying School. Salisbury Airport, Maryland, Wicomico County

Michigan

LEARN TO FLY IN DETROIT
modern planes used
ANDERSON
every student a booster
write
HARRY ANDERSON
Box 1471 R. No. 1 East Detroit, Mich

The fact that schools advertising in the WHERE TO FLY section of AVIATION have done so over a period of years is one of the best testimonials to the efficiency of this type of advertising.

For advertising rates and other information, address—

SEARCHLIGHT DEPARTMENT
Tenth Ave at 36th St.
New York

WHERE TO FLY

Missouri

PARKS AIR COLLEGE

Complete flying and ground courses under licensed transport pilots. New Travel Airs with OX5 Whirlwind and Comment motors. Send for free copy of Sky-ward Ho!, profusely illustrated catalog.

PARKS AIR COLLEGE
704 No. Thro Bldg.
St. Louis, Mo.

New Jersey

NEWARK AIR SERVICE INC.

LEARN TO FLY!

Six new ships. Students trained by expert instructors having at least 10 years active flying experience. Rates moderate, no bond for sale. Most conveniently located air port in metropolitan area. 30 minutes from N. Y. C. Take tube to Newark and No. 4 bus to

NEWARK METROPOLITAN AIR PORT
Newark, N. J.

Write Capt. J. O. Donaldson at above address
Telephone Mulberry 1310

Ohio

FLYING SCHOOL OF THE
The EMBRY-RIDDLE Co.
AIRMAIL - CONTRACTORS
LUNKEN AIRPORT, CINCINNATI, O.

Thorough painstaking methods are responsible for this school's country wide reputation. Leading figures in aviation send students here. Ten hours minimum instruction. 20 if necessary for 1 hour guaranteed solo. No bond, only modern planes. Noted pilot-designers conduct ground school.

Illustrated Folder on Request

Distributors FAIRCHILD

Missouri

NB1

ROBERTSON FLYING SCHOOL
Lambert-St. Louis Airport Anglum, Missouri
one of the
Universal Aviation Schools

New Jersey

AIRVIEW FLYING SERVICE, Inc.

Red Bank, New Jersey
Waco and Fairchild Aerial Taxi Service to Any Point. Flying School Operated from the Finest Field on the Jersey Coast
Hangar Space at Reasonable Rates

Ohio

SPRINGFIELD FLYING SCHOOL

Complete ground and flight instruction. We train for any grade of license. The Littleleriner Flying Service, Inc., Municipal Airport, Springfield, Ohio. Distributors of Travel Air Planes, Central Ohio.

Minnesota

NB 113

MID-PLANE FLYING SCHOOL
Wold-Chamberlain Field Minneapolis
one of the
Universal Aviation Schools

New York

FLY!

Licensed Planes
Licensed Instructors
Modern Equipment
Write for Information

Barrett Airways, Inc.
BEDFORD ROAD (ROUTE 22)
Armonk, New York
Tel. Armonk Village
N. Y. Office—Tel. JErome 7245
"In the Heart of Westchester County"

Oklahoma

NB161

BRANIFF FLYING SCHOOL
Municipal Airport Oklahoma City, Okla
one of the
Universal Aviation Schools

Minnesota

NB314

UNIVERSAL FLYING SCHOOL
Rochester Airport Rochester, Minn
one of the
Universal Aviation Schools

Pennsylvania

PITCAIRN AVIATION of PENNSYLVANIA, Inc.

10 HOUR FLYING COURSE. 4-way flying field, at Willow Grove, Pa., the largest in the East, in midst of ideal flying country. All-year-round school. Modern flying equipment including Pitcairn Orowings. Reasonable board and lodging near field. No liability bond required.

Write for Illustrated Booklet

Land Title Building
PHILADELPHIA

Minnesota

NB 118

UNIVERSAL FLYING SCHOOL
St. Paul Airport St. Paul, Minn.
one of the
Universal Aviation Schools

New York

CURTISS FLYING SERVICE, Inc.
Clinton Road Garden City, N. Y.

In 1927 this Company flew more than 295,000 miles, carried 10,700 passengers, and graduated 224 flying students. Air fleet of sixteen planes, equipment and personnel licensed by Department of Commerce. Phone Garden City 2595

Write for Flying School Booklet

PROFESSIONAL SERVICES

BLACK & BIGELOW, INC.
Air Transport Engineers
597 Fifth Avenue New York, N.Y.

SHOWALTER-ASSOCIATES
Airport Planners-Architects-Engineers
2210 Park Ave
DETROIT
Suite 247 Write or Wire

The thing to do,

when you have knotty construction problems that you can't quite figure out is to call an Airport Engineer. He can help you most.
Play safe—Consult this directory

AIRCRAFT SERVICE DIRECTORY

See our Advertisement
on inside back cover of this issue.
PIONEER INSTRUMENT COMPANY
754 LEXINGTON AVE. BROOKLYN NEW YORK

STEARMAN, STINSON AND MONOCOUPE
GEO. A. WIES, Inc.
Hangar and Office Curtiss Field
Garden City New York

FLYERS INCORPORATED
OX5 and Whirlwind overhauling, all types airplane rebuilding, most complete shop in central and northeastern New York
ALBANY AIRPORT N. Y.

GARDEN CITY TELEPHONES CEDARHURST 1234
Addington Aircraft Co.
SWALLOW DISTRIBUTORS
IMMEDIATE DELIVERY DEALERS WANTED
Connecticut, New Jersey, New York, Maryland, Delaware, Rhode Island, Massachusetts
P. O. Box 82 Mineola, N. Y.
Hangar 60 Curtiss Field

AVIATION ENGINES REBUILT
Our equipment includes HEALD CYLINDER GRINDER, LANDIS CRANKSHAFT GRINDER, WADELL LINE REAMING FIXTURES for main and connecting rod bearings.
OX5'S A SPECIALTY
Can furnish all parts.
Bring Your Engine Back to Former Efficiency
Write for information and prices
Spencer-Turnbull Co., 278 Main St.,
Hartford Conn.

LUDINGTON PHILADELPHIA FLYING SERVICE, Inc.
Operator of Philadelphia Airport
FAIRCHILD Distributors WACO
Most completely equipped airport in Penn.
ALL SERVICES
Best and Quickest Repair Facilities in East

AIRPLANE SPRUCE
Large assortment of kiln dried Spruce, graded in accordance with U. S. Specifications by Pacific Lumber Inspection Bureau. Write for prices on one piece or a carload.
FRANK PAXTON LUMBER CO.
Kansas City Kansas

OLE FLOTTORP'S RECENTLY
DEVELOPED PROPELLER
is very efficient and operates with less fluttering or vibration
For sale by all supply dealers or factory
FLOTTORP PROPELLER COMPANY
1836 Linden Ave. S.E. Grand Rapids, Mich.

TRIUMPH
MAGNETIC
FUEL GAGES FOR AIRCRAFT
NEW MODELS FOR COWL, WING, OR SPECIAL TANKS
Manufactured by
The Barton Auto Gage Company
PITTSFIELD MASSACHUSETTS

CHICAGO
International Aircraft Exhibit
September 7 to 15 1929
COLISEUM
Address: Leiter Building Chicago

PLYCOR Aircraft Plywood Meets All Tests
A HIGHLY SPECIALIZED PRODUCT
Furnished in the following thicknesses
Panels entirely without seams on either side
THE PLYCOR COMPANY
Western Ave. Chicago Illinois

GARDNER PROPELLERS
In Stock or on Short Notice
12 Years Experience
GARDNER PROPELLER WORKS
Forest Park, Ill.

LICENSE COURSE
FREE, complete 24 hour private license course, including navigation, meteorology and mechanics, with every American Eagle Airplane purchased from us before May 1st.
Montgomery School of Aeronautics
Montgomery Airfame

BRAND **OX5** NEW
MOTORS
Dual ignition high compression—one or a carload
F. C. Tank, 278 1st Ave., Milwaukee, Wis

SEAMLESS STEEL TUBING
Made to Aircraft Specifications 10225 D
Warehouse stock also mill shipment
The Cleveland Tool & Supply Company
1427 1437 West Sixth St. Cleveland O

BRAND **OX5** NEW
MOTORS
DUAL IGNITION HIGH COMPRESSION
One or a Carload
In writing for prices, state quantity desired.
F. C. TANK, 371 1st Ave., Milwaukee, Wis

AEROPLANOS-MOTORES-ACCESORIOS
AGENTE
SAM A. TICKELL
285 Adams St. Brooklyn N. Y. U. S. A.

AIRPLANE SPRUCE
Specialists in Airplane Spruce for Fifteen Years
J. V. O. POSEY & COMPANY
Public Service Building, PORTLAND ORE.

Have a special built airplane or parts made by expert mechanic.
PAUL DORLER
189 Main Street Hempstead, N. Y.

engine cowls
propeller noses
streamline wheel fairings
Spun and hand-hammered work in dural or aluminum to order.
MAGOSY & BUSCHER
120 WALKER STREET NEW YORK CITY

IF YOU do not find what you want advertised here, write to **Searchlight Dept., Tenth Avenue at 36th Street, New York.** You will be put in prompt touch with reliable sources of supply.

RADIATORS THAT COOL PERFECTLY
Airplane radiators to your specification or design for Curtis, OX, Hisso, for either water or oil cooling
YOUNG RADIATOR CO. Racine, Wis

Build a Flying Model Airplane
U. S. MODEL AIRCRAFT CORP.

Patent Your Ideas
Send me a sketch or simple model of your invention. SATISFACTORY TERMS
Free Confidential advice Illustrated Literature
DO IT NOW!
PATENTS
NEW YORK
REG. PATENT ATTORNEY

Send for Catalog
32 STYLES
AVIATION GOGGLES

For Professional Services
See Page 1382

SEARCHLIGHT SECTION

EMPLOYMENT and BUSINESS OPPORTUNITIES—USED and SURPLUS NEW EQUIPMENT

UNDISPLAYED—RATE PER WORD
Positions Wanted, Positions Vacant and all other classifications, excepting equipment 10 cents a word, minimum $2.50 an insertion 15 cents a word if a box number address care of any of our offices is used
Proposals 40 cents a line an insertion

INFORMATION:
Box Numbers may be in care of our New York, Chicago or San Francisco offices
Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals)

DISPLAYED—RATE PER INCH
1 to 3 inches $6.00 an inch
4 to 7 inches 5.75 an inch
8 to 14 inches 5.50 an inch
Other spaces and contract rates on request
An advertising inch is measured vertically on one column 3 columns—30 inches—to a page

FOR SALE

BIG SALE of Aeroplanes. Positively the best buys in the United States—Two Whirlwind Wacos perfect condition loaded with extras two Waco 10s with OXX-6 motors, same as new, two Waco nines with OX5 motors, A-1 condition, two Travel Aire one with OXX-6 motor and Scintilla magnetos (see this ship), one Pheasant with or without motor, two Eaglerocks, combination wing, excellent condition throughout. These ships are all licensed and must be seen to be appreciated Priced from $1,200 to $8,000 We specialize in the sale of planes and motors carrying a complete line of Waco ships and several other makes, both new and used Free flying instructions with any new or used ships purchased from us Act now. Be ready when the season opens Becker & Forser Flying Service Inc, Jackson, Mich

BARGAIN—Curtiss JN6H 150 Hisso ship completely rebuilt last November covered with genuine linen motor just completely overhauled, run in bed 3 hours in air ship kept in hangar used privately, perfect condition. Can be licensed $1,050 flyaway D F Odom 4301 So Presa, San Antonio Texas

BRAND new OXX6 motors original crates for $700 also new OX 5 motors at the same price. Guaranteed brand new OX5 and OXX6 cylinders at $25 each Brand new Rocker arm assemblies $60 per set of eight. OX5 pistons, valves pumps crank cases, all new and at reasonable prices One brand new Monocoupe flown home from factory kept in first class hangar and not a scratch on this plane price $2,000 One OX5 Waco 10 new April 1928 equipped with D H wheels price $2,000 One new combination wing OX5 Eaglerock with air speed indicator and D H wheels and always kept in hangar log shows 80 hours, price $2,000 One brand new 110 hp. Anzani motor all complete $300 Write to C. J Wege, Ferney South Dakota

COMBINATION wing Eagle rock, exactly one year old perfect condition dual controls flown less than two hundred hours has not been used for students or stunting Ready to fly any distance Write for price Box K, Georgetown Ill

COMPLETELY rebuilt OXX-6 100% job with new mags lots of spare parts. Price crated $500 E J Dorr 18 Roseway St Jamaica Plains Mass

RYAN BROUGHM

1928 with or without brand new Whirlwind J5, priced $9000 or $5000 Also

CURTISS ROBIN

50 hours and extra complete overhauled splendid OX5 both for $3700 equipped with Curtiss Reed Prop

ALBANY AIR SERVICE
Albany Airport N Y

FOR SALE—Three-place Swallow completely overhauled new paint pigmented dope finish on wings, new Pioneer instruments, board with new type compass, includes turn and bank indicator, perfect condition under mechanic surveillance at all times, under 100 hours, price $1500. C. H. Petersen, care of George Wies Hangar, Curtiss Field, Garden City, L. I., N. Y.

FOR SALE—220 HP Lorraine Dietrich. Will trade for air-cooled engine for Pickard Monoplane, or 35 HP Joe Harvermy, 588 Madison St., Hartford Conn.

HARLEY twin with prop, extra mag, for sale. Nicolo motor parts. Ans to 420 Box 330 Hornell, N. Y.

$875 buys a Lincoln Sport plane powered with a 35 H.P. Anzani Motor mechanical valves. Ship has no hours except test flight. Morgan Cyril Shop, Fort Morgan, Colo.

NEW OX5 cylinders are getting scarcer every day. We make your used cylinders like new valve guides installed $1.50 per guide; new valve seats installed $1.00 per seat. Cylinders rebored our specialty. Albany Airport, Albany, N. Y.

ONE OX5 American Eagle biplane like new, dual controls, used as demonstrator, flown 40 hours since new, price $2700. One OX5 Waco nine, $1,600, both licensed and in excellent condition. Can be seen at Hebron Airport, Hebron, Nd.

O X 5 SWALLOW like new guaranteed perfect condition, dual control Miller valve action, 137 hrs. total, 4 hrs. since complete overhaul. Licensed, kept in hangar. Priced for quick sale at $1,500. 102 15th St. Chicago Heights, Ill.

O X 5 PACIFIC STANDARD for Sale—Motor and ship completely overhauled with new covering, rebuilt to Department of Commerce specifications for C license. Price $1250. Chas. G. Offutt, Petaluma, Calif.

OX5 Travel Air in first-class condition, for sale. Purchased new last July, 200 hours. Price $2,250. G. C. Roberts, 1130 Cleveland Ave. East St. Louis Ill.

PRACTICALLY new complete Le Rhone for sale, 80 hp, for $85. New Le Rhone propeller $25. David Basil, 125 Capitol Ave., Hartford Conn.

RYAN BROUGHAM used by owner for pleasure trips only, less than 150 hours. Motor and ship guaranteed perfect condition. Ship in hangar at all times. 277 Genesee St., Buffalo, N. Y.

SIX place Ansaldo cabin ship for sale, 300 hp Fiat motor. Perfect flying condition. Great sacrifice. Immediate delivery. American Air Transport Inc., Toledo, Ohio.

SUPREME propellers will give you better performance. Mail us your orders. The Auto-Equip Company, Rocky Mount, N. C.

$2,100 buys Waco 10, brand new, OX5, large wheels, Curtiss fixed metal propeller and dual control, will take ship in trade and cash difference on used. Indianapolis Air Service Co., Academy of Aeronautics, 3920 Balsam Ave., Indianapolis, Ind.

STINSON Junior Warner Scarab purchased new last October, 100 hours, 20 hours since complete factory overhaul, equipment includes Pioneer compass, Waltham clock, Pioneer bank, turn and climb, Hamilton steel propeller, ship in perfect condition throughout, licensed by Department of Commerce, owner selling at sacrifice to buy larger ship $6,000 cash takes it. J. L. Moss, Jr. 367 No. Michigan Ave. Chicago Ill.

STANDARD with OXX6 motor Curtiss Reed propeller, ship just completely rebuilt from nose to tail including wires and woodwork, new Switlik covering, motor also rebuilt, ship has ten hours since job was finished by Ray Moore, Ship at Miami, license pending inspection, perfect for club. $1,250 including many spare parts. Write or wire Buck, Box 2274 Palm Beach Fla.

THE Wright tested plane—Pobjoy ship just completely rebuilt, steel Hastings covered wings, dual control, adjustable stabilizer, new control cables. Whole ship recently overhauled and in excellent condition. Top speed with Whirlwind J-4 about 125 m.p.h. To be sold with used J-5 engine, factory overhauled, at $5,000 net. Flyaway Teterboro Airport N. J., or without engine at best offer. Wright Engine Sales Division Wright Aeronautical Corporation, Paterson, N. J.

THE best J4B can be bought for $3,000, new carburetor and one magneto. If you want speed you want this motor. You know what speed is as made in the National Air Races—this motor was third fastest of all starters and gained 30 hours during the race. No trades. Stuart P. Anger, Century Bldg., Milwaukee, Wis.

TEN Willys Morrow OX5 motors for sale. High compression cylinders guaranteed to turn 1,600 on the stand, ready to install in your new ship. $400 each. Motors stored in Michigan. Rudolph Anger, Leland Miss.

THREE-PLACE Pacer monoplane for sale with Wright J5 motor, mounted, all in excellent condition. $2,600 less motor. E. B. Hamann, Syracuse Airport, Syracuse, N. Y.

TRAVEL-AIR for sale, less than 200 hours perfect condition, Curtiss OX5, complete Miller valve action. For quick sale $2,500 cash. H. J. Boyd, 4306 Frond way, Indianapolis, Ind.

TWO (2) OX5 Travel Air biplanes for sale, like new, dual controls and complete. Both licensed. Priced to sell. Can be seen at Flue Brook Airport Flue Brook N. J. Union Airways, Inc.

FOR SALE

WACO 10- OXX-6 motor for sale, equipped two scintilla magnetos, Miller intake mechanism, condition A-1, also one OXX-6 motor J F Cavanagh 2010 N 17th St Philadelphia, Pa

WACO TEN, new never flown $500 off for quick cash deal 1929 demonstrator, licensed and a beauty at a discount OX5 motor used only 10 hours, will guarantee $600 New York Aircraft Distributors, Inc., Curtiss Field, Garden City L. I. N Y

EQUIPMENT WANTED

ANY type of radial motor wanted, which is damaged beyond repair to be used for class room purposes. Must be low in price Curtiss Flying Service of Indiana Inc 657 N Meridian St, Indianapolis Ind

GOOD Late Production Ship Wanted—State lowest cash price with and without motor No junk Also interested in a OXX 6 or Hisso motor Broadway Auto Service, 596 Broadway, Providence R I.

SPORT ship or complete parts in exchange for new saxaphone and $220 building and loan bond. Write H H Brindley Peabody Kan

THREE-PLACE PLANE Wanted—Waco, 10, Swallow type; have $1,000, and, if necessary, a late model rumble seat sport roadster like new $200 extra equipment, state full details first letter Matthew Barys 76 Suydam St, Brooklyn, N Y

WANTED—Used OX-5 and OXX-6 motors complete or parts for same. R. A. Jostle 1744 N Euclid St Louis, Mo

WANTED—Pair of Thomas Morse S-4-B ailerons, rudder elevator vertical fin State lowest cash price and condition in first letter Elwyn West Menasha Wis. R. 1

WANTED—Travelair Swallow or other late production ship must be in good condition State price type of motor hours etc first communication Ted Tellikorb, 538 Broadway Buffalo N Y

WANTED—25 or more OX-5 motors, new or used Write E Thomas, 1-17 Haverkamp Street Brooklyn N Y

POSITIONS VACANT

LICENSED airplane and engine mechanic wanted Steady job chance for advancement. Salary $2,080 yearly to start. Barrett Airways, Inc Armonk N Y

TRANSPORT pilot wanted to instruct and manage our field State experience record and references first letter Hornell Airways Inc Hornell N Y

WANTED
0X5 MOTORS
New or used, in any quantity.
J. J. SINKEL
79 Emerson Place Brooklyn N Y

POSITIONS VACANT

TRANSPORT PILOT Wanted to give instructions and carry passengers. Wellsville Aviation Club Inc., North Main St. Wellsville, N Y

EMPLOYMENT AGENCY

LICENSED and Unlicensed Pilots and Mechanics furnished at once Unemployed Airmen list your qualifications with us Bennett's Airmen's Directory, 423 West Sixth St, Kansas City, Mo

POSITIONS WANTED

AERONAUTICAL engineer with long experience in research design and manufacture Technical graduate combining exceptional mathematical ability with practical shop experience and natural mechanical ingenuity Successful plane to credit. Can handle efficiently all matters of engine and plane design aerodynamics and stress analysis. PW 30, Aviation, 7 So. Dearborn St, Chicago, Ill

LIMITED Commercial Pilot over 100 hours cross country and barnstorming Hopping passengers now for Illinois-Iowa Airways, Rock Island Desire full time position PW-31, Aviation, 7 So Dearborn St., Chicago, Ill.

PILOT sixty hours flying time some cross country experience Wishes to get time necessary for transport license. Will work hard for small salary and will go anywhere in the U. S. in order to get flying time PW 28, Aviation, Tenth Ave at 36th St, New York

TRANSPORT PILOT Kelly Field graduate 1918, ten years experience commercial pilot 2,500 hours flying, best of references Only most reliable connections considered Available 15 days notice PW-1:19 Aviation 7 So Dearborn St. Chicago, Ill.

UNLICENSED mechanic wishes position Will work for small wages and flying hours Age 21 Roland Ralppe Waterville Kan

WAR PILOT 2,000 hours, five years sales experience. Can stress, analyze design engineers Two years manufacturing supervisor What do offer Will do anything PW-23 Aviation 7 So Dearborn St., Chicago Ill

YOUNG MAN Technical Graduate Wishes aviation connection manufacturing or operating seven years automotive experience covering design sales, and management Knowledge of aerodynamics Now holding responsible position with large transportation corporation. PW 27 Aviation 7 So Dearborn St Chicago, Ill

MISCELLANEOUS

Wanted Corporation with Pilots and Planes to instruct flying school Make passenger flights, also agent Standard Planes at Mid Valley Airport, a municipal port Located in heart of Anthracite Valley 500-000 population 8 miles from Scranton 2½ miles of Olyphant William Sbonnit mgr, Mid Valley Air Port Olyphant Pa.

ATTENTION AVIATORS Valve guides installed on OX cylinders, $1.50 per guide, removable valve seats installed $1.00 descriptive literature upon request all work guaranteed Illinois Flying Co, New location 4 West 4th St, Sterling, Ill.

MISCELLANEOUS

DEALERS wanted for the Swallow Airplane Southern New Jersey Connecticut, Rhode Island and Massachusetts. Addington Aircraft Corp Mineola, L. I

FIFTY Young Men Wanted—Learn to fly and take charge of airport operations. Write for particulars Kroeger Airlines Inc Stuart Fla

MACHINE shop service on OX-5s. Cylinders reground, new pistons pins and rings. Graphite guides and inserted seats installed Oversize pins installed in valve actions. Main and connecting rod bearings line reamed. All work guaranteed New OX-5 parts Write for complete circular Heckman Machine Works, 4028 West Lake St., Chicago Ill.

SHERWIN-WILLIAMS dopes are better Mail us your orders The Auto-Equip Co, Rocky Mount, N C

STANDARD J1 for sale, in perfect condition in every respect. $1100 Eagle Airplane Co., Inc., Rocky Mount, N C

WOULD like to trade OX5 Standard in perfect condition on used new production ship less motor The Auto-Equip Co Rocky Mount, N C

SPEED TEX 72 in. wide, 65 cents yd Grade A Cotton 80 in wide 38 cents yd. 2 in pinked tape 3½ cents yd Joe Edeskuty Aircraft, 1727 11th Ave., So Minneapolis Minn.

WILL TRADE late model Packard Six Sedan in perfect condition for a WACO nine airplane, must be licensed Harry B Rummel, Findley, Ohio

WILL trade late model Chrysler 70 roadster for new production ship, with or without motor M 23 7 So Dearborn St, Chicago, Ill.

BUSINESS OPPORTUNITY

WANTED
A Finance company to finance retail airplane sales. Rummel Air Service, Ltd., Findley Ohio

FOR SALE OR RENT
Estate of 130 Acres with Ground Suitable for Aviation Field or Manufacturing
2½ miles from R.R. Station of the City of Attleboro, Mass., 5 miles from R.R. Station of Pawtucket, R. I. Location on good state road
L. LAPRADE
c/o Potter & Johnston Mach. Co.
Pawtucket R I

The "Searchlight" Advertising in This Paper

is read by men whose success depends upon thorough knowledge of means to an end—whether it be the securing of a good used plane at a moderate price, or an expert pilot,

THE BEST PROOF of this is the variety of the Searchlight ads Without a constant and appreciable *demand* for such equipment or service, by its readers, the market-place which these advertisements represent could not exist for any length of time

ARE *YOU* USING THE SEARCHLIGHT SECTION?

INDEX TO ADVERTISERS

Only reliable products can be continuously advertised

A Personal Want—

can invariably be filled by a friend

The Searchlight Section

of this issue covers the current business wants of the industries in which this paper is read.

For Every Business Want

"*Think* SEARCHLIGHT *First*"

A Business Want—

must be satisfied by someone in your industry

3134

MANUFACTURERS' SPECIFICATIONS ON AMERICAN COMMERC

THE TABLE BELOW IS BELIEVED TO BE ACCURATE BUT *AVIATIO*

This table will appear monthly and

MANUFACTURER	Designation	Price of Plane at Factory	Type	No. of Seats	Make of Engine	Total Rated HP	Make of Propeller	Span	Wing Area (Sq Ft)	Length Overall	Height Overall	Weight Empty (Lb) (With Water if Water Cooled Engine is Used)	Pay Load (Lb)	Disposable Load (Lb)	Normal Gross Weight Loaded (Lb)	Wing Loading (Lb per Sq Ft)	Power Loading (Lb per Hp)
Advance Aircraft Co	Waco 10	$5,535	OBL	3	Sh 12	125	H Hs SS	30' 7	286	23' 9"	9'	1,330	370	690	2,025	7.08	16.2
Advance Aircraft Co	Waco 10	2,035*	OBL	3	OX 5	90	Hs	30' 7	286	23' 6"	9'	1,225	200	600	2,025	7.08	22.5
Advance Aircraft Co	Waco 10	2,505*	OBL	3	E	150	H Hs SS	30' 7"	286	23' 6"	9' 3"	1,508	200	1,092	2,600	9.09	17.5
Advance Aircraft Co	Waco 10	7,341	OBL	3	J 5	200	H Hs SS	30' 7	286	22' 9"	9' 3"	1,550	200	1,050	2,600	9.09	15.0
Aero-Craft Mfg Co	Aero-Coupe	5,000	SBL	5	W	110	F	52	250	24'	8' 0"	1,100	550	1,000	2,100	8.40	19.0
Alexander Aircraft Corp	Eaglerock A 1		OBL	3	J 5	200		36' 8"	330	24' 11"	9' 11"				2,491	7.54	12.4
Alexander Aircraft Corp	Eaglerock A 2	2,250*	OBL	3	OX 5	90		36' 8"	330	24' 11"	9' 11"				2,442	7.40	27.1
Alexander Aircraft Corp	Eaglerock A-4		OBL	3	E	180		36' 8"	330	24' 11"	9' 11"				2,618	7.93	14.5
American Eagle Aircraft Co		2,985	OBL	3	OX 5	90	H Hs	30	300	24' 0"	8' 4	1,227	840	850	2,057	8.85	22.8
Arrow Aircraft Corp	Arrow-Sport	2,257	OBL	2	LB	60		25' 0"	176	19' 2"	6' 11"	524		450	974	5.35	19.2
Bach Aircraft Co	Air Yacht	51,700	CML	10-12	2 Sh 12 & W	650	2 Sty SS	52'	412	36' 1	9' 6'	5,500		5,200	6,200	15.77	[illegible]
Bellanca Aircraft Corp	CH	14,500	CML	6	J 5	200	Hs	46' 4	273	24' 9'	8' 6"	1,850	7,229	5,284	5,134	10.90	25
Berliner Aircraft Co	CM 4	3,295	OML	3	OX 5	90	H Hs	36	211	25' 10"	8	1,400		900	2,300	10.90	25.5
Berliner Aircraft Co	CM 5	8,950	OML	3	J 5	200	SS	36	219	25' 10"	8	1,675		1,025	2,700	12.32	13.50
Bird Wing Commercial Airplane Co	No 0	2,795	OBL	3	OX 5	90	Hs	31' 4	305	23' 6"	8' 7'	1,236	550	1,019	2,255	7.44	25.0
Boeing Airplane Co	40-B	24,500	SBL	3	P Wh	[illegible]	H M	44' 2'	545	33' 4"	11' 8'	3,545	1,420	2,534	6,079	11.15	15.1
Boeing Airplane Co	40-C	22,500	SBL	5	P Ww	[illegible]	H M	44' 2'	545	33' 4"	11' 8"	3,522	1,445	2,555	6,075	11.14	12.1
Boeing Airplane Co	B 1E	10,000	CBF	4	P Ww	400	HW	39' 8'	546	32' 8"	12'	3,090	750	1,060	4,550	8.36	11.3
Boeing Airplane Co	B 1D	15,000	CBF	4	J 5	200		39' 8"	466	30' 9"	12'	2,445	720	1,000	3,445	7.39	17.2
Bourdon Aircraft Corp	Kitty Hawk		OBL	3	Sh 11	90	W	28	233	21' 11"	8' 0½"	1,115			1,886	8.09	19.0
Breese Aircraft Co			CML	6	J 5	200	SS	41	260	27	10' 0"	155		1,600	2,550	9.80	12.7
Buhl Aircraft Co	Airsedan-C3A	15,500	CBL	5	J 5	200	SS	42'	534	28	10'	2,072	1,000	1,628	5,700	11.02	18.5
Buhl Aircraft Co	Airsedan CA 3C	15,000	CSL	3-4	J 5	200	M	36'	240	25	8' 0"	1,800	655	1,000	2,800	15.55	14.0
Buhl Aircraft Co	Junior Airsedan	8,000	CSL	3	W	110	M	36'	240	25	8' 0"	1,500	570	1,000	2,300	10.40	22.7
Cessna Aircraft Co	3-120	5,750	CML	3	A	120	H Hs	40' 6"	224	25' 8'	7' 4"	1,250	480	750	2,000	8.92	16.6
Cessna Aircraft Co	4-125	4,075*	CML	4	Sh 12	125	H Hs	40' 0"	224	25' 8	7' 4"	1,000	260	1,050	2,200	10.12	16.2
Cessna Aircraft Co	4-200	9,600	CML	4	J 5	200	H Hs	40' 0"	224	25' 8'	7' 4"	1,350	300	1,070	2,420	10.80	12.1
Command Aire Inc	Command Aire	2,450*	OBL	3	OX 5	90	H	31' 6"	300	24' 6'	8'	1,275	575	900	2,175	8.91	25.8
Crawford M & A Mfg Co	A 1	1,500	OML	2	LR	80	own	30'	150	17' 9'	7'	550		450	1,000	9.55	17.5
Crown Motor Carriage Co	B 5		OBL	2-3	K 5	100	S	28' 0"	236	21' 5'	8' 5	800	530	700	1,500	6.35	15.0
Curtiss Robertson Airplane Mfg Co	Robin	4,600	CML	3	OX 5	90	Hs	41'	245	25' 9"	7' 10'	1,489	328	728	2,217	9.04	24.6
Driggs Aircraft Corp	Dart II	1,600	OBL	2	A 3	55	Hs	28'	140	19' 6'	6'	450		370	820	5.85	23.4
G Elias & Bro Inc	Airmique	3,350	CML	2	A	60	Elias	28' 11½"	195	21'	7' 2"	970	510	564	1,334	6.94	16.6
Fairchild Airplane Mfg Corp	Fairchild 51	4,250	CML	2	G	50	HW	28'	139	22'	6' 10½	755		405	1,250	8.99	15.6
Fairchild Airplane Mfg Corp	Fairchild 41	8,950	CML	4	J 5	200	Hw	39'	234	24' 7"	8'	2,000		1,600	3,600	15.38	18.0
Fairchild Airplane Mfg Corp	Fairchild 71	18,600	CML	7	P Ww	[illegible]	SS	50	552	32' 10½	9' 4"	5,000		2,500	5,500	10.5	15.7
Federal Aircraft Corp	CM 1	12,500	CM	5	J 4 B	[illegible]	We	32' 0"	262	29' 3"	9'	2,080	830	1,595	3,475	13.26	17.3
Fokker Aircraft Corp	Universal	14,000	CML	5-7	J 5	200	H Hs	47' 9"	341	33	8' 9"	2,100	1,300	1,900	4,000	11.75	20.0
Fokker Aircraft Corp	Super Univ	19,340	CML	6-8	P Ww	400	SS	50' 6"	382	36' 1	8' 11"	2,900	1,230	2,200	5,150	15.91	15.0
Fokker Aircraft Corp	Fokker F 10	40,600	CML	14	3 P Ww	1,200	SS	71' 2"	728	50' 8"	12' 5"	7,300	2,040	4,950	12,500	14.70	10.4
Gates-Day Aircraft Corp	GD 24	5,200	OBL	5	E	180	H	45'	550	26'	11'	1,700	400	1,300	5,000	9.79	[illegible]
Gillis Aircraft Corp	Crusader		CBL	4	Sh 12	125	Hos	32' 9"	245	23	8' 1				2,300	9.79	19.2
Hamilton Metalplane Co	H-45		CML	8	P Ww	400	H	54' 5"	387	34' 8"	9' 4"	5,300	1,155	2,000	5,750	14.55	14.3
Hamilton Metalplane Co	H-47		CML	8	P Wh	500	H	54' 5"	387	34' 8"	9' 4"	5,450	1,045	2,500	5,750	14.85	11.5
Heath Airplane Co	Parasol	695	OML		H	23	own	23'	94	16' 9"	5' 11"	290		225	515	5.47	22.3
International Aircraft Corp	F-17	2,050	OBL	3	OX 5	90	H	35'	525	25'	9' 6"	2,090	520	620	2,100	6.49	23.5
International Aircraft Corp	F-18	12,250	CBL	5	J 5	200	SS	37'	360	27' 6"	10' 0"	2,200	950	1,550	3,750	10.41	18.7
Ireland Aircraft Inc	Neptune	14,000	CMA	5	J 5	200	CR	40'	350	31' 0"	11' 9"	2,250	750	1,550	5,600	10.30	18.0
Irwin Aircraft Co	M T-2	1,165	OML	1	I79	25	own	26'	105	13' 8"	5' 9'	275	100	300	575	5.47	23.6
Keystone Aircraft Corp	Patrician	65,000	CML	20	3 Cy	1,575	SS	90'	1,000	63'	15'	8,505	5,680	2,615	15,000	15.00	9.5
Keystone Aircraft Corp	Pathfinder		CBL	12	3 J 5	[illegible]		66' 9	1,150	46'		8,536	1,000	4,481	10,841	9.42	10.0
Kinner A & M Co	Courier		OML	2	K	100	SS	55'	210	23'	7	915		550	1,465	6.78	14.6
Kreider-Reisner Aircraft, Inc	Challenger	2,400*	OBL	3	OX 5	90	Hs H	30' 1"	285	23' 9"	9' 6'	1,200	412	811	2,000	7.01	22.2
E. M. Laird Airplane Co.	Commercial		OBL	3	J 5	200	SS	34'	300	23' 9"	9' 3'	1,550	600				
Laird Aircraft Corp	Whippoorwill		CBL	4	J 5	200		38'	351	27'	9'	1,650		1,000	2,650	7.54	15.5
Lincoln Aircraft Co	Lincoln Page		OBL	3	OX 5	90		32'	300			1,090	450	1,000	2,200	7.55	24.4
Lockheed Aircraft Co	Vega		CMI	5-7	J 5	200	SS Ww	41'	275	27' 5"	8' 0'	1,650	1,000	1,550	3,300	11.64	[illegible]
Lockheed Aircraft Co.	Air Exp		CMI	5-7	P Ww	400	SS	41'	275	27' 5"	8' 0	1,050	1,000	1,845	3,645	15.25	9.1
Loening Aeronautical Engr Corp	Cabin Amphibian	26,700	CBA	8	Cy	525	SS	46' 0'	517	34' 8½"	13' 2	3,950	1,100	1,950	5,900	11.41	11.5
Mahoney Ryan Aircraft Corp	Ryan B-1	12,200	CML	5	J 5	200	H W	42	296	27' 5"	9' 10"	1,870	800	1,430	3,300	11.52	16.5
Metal Aircraft Co	Flamingo G 1		CML	[illegible]	P Ww	400	Ss	48	354	30'	9'	2,800		2,050	4,850	[illegible]	15.1
Mono Aircraft Inc	Monocoupe	2,675	CML	2	V	55	Hs	30'	150	19' 8	6' 5'	700		475	1,175	7.45	21.3
Mohawk Aircraft Corp	Pinto	2,775	OML	2	V	55		30' 6'	124	22	5' 3'	850	200	500	1,350	[illegible]	24.5
Nelson Aircraft Co	Williams		DML	1	Sz	40		28	100	19	6' 8"	440					
Pheasant Aircraft Co Inc	H 10	2,375	OBL	3	OX 5	90	Hs	32' 6"	283	23' 6'	9'	1,297	400	785	2,082	7.55	23.1
Pitcairn Aviation Inc	Mailwing	10,000	OBL	1 5	J 5	200	Ss	33	252	22' 10"	8' 10'	1,912	600	770	2,512	[illegible]	15.5
Pitcairn Aviation Inc	Super Mailwing		OBL	1 2	J 5	200		33	262	22' 10½	9' 3'	1,840		1,160	3,000	11.06	15.00
Pitcairn Aviation Inc	PA-4		OBL	3	OX 5	90	Hs	30	226	21' 10"	8' 7	1,185		765	1,950	8.92	21.6
Prudden Aircraft Corp	S-E-1	22,500	CML	8	P Ww	400	SS	57	427	38'	9' 5	5,000	1,200	2,065	5,065	11.86	12.66
Richmond Airways, Inc	Sea Hawk		OMF	5	C 6	160		46	512	28'		1,700		1,000	2,700	5.51	18.12
Sikorsky Mfg Co	S-37		CBL	18	2 P Wh	1,000		100'	1,049	45' 6'	19' 3'	8,000	4,060	7,000	15,000	14.29	15.00
Sikorsky Mfg Co	S-38 Amphibian		COA	14	2 P Ww	800	SS, H	71' 8"	720	40' 3"	13' 10"	6,000	2,210	4,600	10,600	15.88	15.5
Simplex Aircraft Corp	Red Arrow	3,950	CBL	2	K 5	100	Sty	33' 4'	148	20' 5"	8' 10"	1,000		800	1,800	10.81	19.0
Starling Aircraft Co			OBL	3	OX 5	90		32'		23' 4"	9'	1,237		600	1,837		20.4
Stearman Aircraft Co	C-3 K	8,740	OBL	3	Sh 12	125	H Hs	35'	296	24	9'	1,285	550	865	2,150	7.26	17.20
Stearman Aircraft Co	C-3 B	8,750	OBL	3	J 5	200	H CR	35'	296	23	9'	1,458	400	902	2,800	9.10	12.00
Stinson Aircraft Corp	SM 1D	12,500	CML	6	J 5	200	H	45' 10'	292	32	8' 6"	2,400	1,340	2,100	4,300	15.41	22.50
Stinson Aircraft Corp	Junior SM 5	8,950	CML	4	W	110	Wd	41' 9"	226	26' 3"	7' 9"	1,510	595	990	2,500	10.59	22.72
Spartan Aircraft Co	C-3	5,250	OBL	3	Wal	135		32'	292	22' 11"	8' 9"	1,300	448	850	2,150	7.55	15.92
Stout Metal Airplane Co.	4 AT		CML	12	3 J 5	600	SS	74'	785	49' 10"	12' 8	9,200	2,200	3,800	10,600	15.75	[illegible]
Swallow Airplane Mfg Co.	Commercial		OBL	3	OX 5	90		32'	300	24	8' 0"	1,470	200	730	2,200	7.55	24.44
Taylor Bros Aircraft Co	Chummy	5,000	SML	2	K 5	100		34'	175	22	7' 6'	950	160	550	1,500	8.57	15.00
Texas Aero Corp	Temple		OML		J 5	200		37' 4"	225	25' 10"	8' 5		567		2,250	10.00	11.25
Thaden Metal Aircraft Co	T 1		CML	7	P Ww	400		55'		35	11'	2,600		[illegible]	5,100		15.77
Thunderbird Aircraft Inc	W 14-O	2,950*	OBL	3	OX 5	90	Sty	34'	228	24' 8"	9' 7'	1,433	340	815	2,248	[illegible]	24.97
Thunderbird Aircraft Inc	W 14-H		OBL	3	E	150	Sty	34'	228	24' 8	9' 7"	1,551	500	945	2,496	10.97	[illegible]
Travel Air Mfg Co	2000	2,950	OBL	3	OX 5	90	H Hs	34' 8"	296	24' 2"	8' 9"	1,550	550	750	2,300	7.09	23.33
Travel Air Mfg Co	4000	9,100	OBL	3	J 5	200	H	34' 8"	296	23' 6"	8' 9'	1,400	400	1,600	2,900	8.78	15.00
Travel Air Mfg Co	6000	15,000	CML	5	J 5	200	SS H	[illegible] 7"	282	30' 10½"	8' 8½"	2,475	944	1,625	4,100	14.55	20.50
Travel Air Mfg Co	9000		OBL	3	Sh 12	125	W	34' 6'	296	24' 2	8' 9'	1,250	360	860	2,210	7.46	17.60
Wallace Aircraft Co	Touroplane	2,500*	CML	3	A	80	Du	37	205	23' 6'	7' 6"	850	520	650	1,800	7.51	18.75
Whites Aircraft	Hum Bird	2,150	OBL	3	OX 5	90	Hs	35' 1"	318	23' 6"	8' 3"	1,050	450	850	1,900	5.94	21.11
Western Airplane Corp	King Bird	7,000	OBL	3	OX 5	90	Hs	35	320	25' 4"	9'	1,000	400	800	2,600	6.25	22.22
Zenith Aircraft Corp	Albatross	55,000	CML	14	3 Sh 12	575	Sty	90'	1,052	50	12' 6"	4,000	5,600	7,600	2,600	1.93	5.35

TYPE
A —Amphibian
B —Biplane
C —Closed
F —Flying boat
L —Landplane
M —Monoplane
O —Open
Q —Sesquiplane
S —Semi-closed
W —Seaplane

ENGINE One engine unless stated in italics
A —Anzani
C 6 —Curtiss
Cy —Wright Cyclone
E —Wright Hispano-E
G —Genet
H —Henderson
I79 —Irwin
J 5 —Wright Whirlwind
K —Kinner
L —Liberty
LB —Le Blond
LR —LeRhone
OX 5 —Curtiss
P Wh —Pratt & Whitney Hornet
P Ww —Pratt & Whitney Wasp
SR —Super Rhone
SH —Siemens Halske
Sz —Szekely
V —Velie
Wal —Walter
W —Warner
* —Price without engine

PROPELLER
CR —Curtiss Reed
H —Hamilton
Hs —Hartzell
M —Metal
Sty —Story
SS —Standard Steel
W —Wood
Ws —Westinghouse

FUSELAGE AN
B —Belted
Cor —Corrugated
D —Duralumin
F —Fabric cov
Mon —Monocoque
O —Open rect
BRAKES
B —Bendix
Ex —Extra
H —Hydraulic

CIAL AIRPLANES AND SEAPLANES AS COMPILED BY *AVIATION*

ON DOES NOT ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN

l corrections and suggestions are invited

High Speed in M P H	Cruising Speed in M P H	Landing Speed in M P H	Climb at Sea Level in F P M	Climb to 10 000' in Minutes	Service Ceiling in Feet	Fuel Capacity in Gallons	Normal Range in Miles	Normal Fuel Consumption at Cruising Speed Gal Per Hr	Fuselage Construction	Wing Construction	Are Wings Wired for Lighting?	Type of Control	Brakes	Type of Shock Absorber	Dept of Commerce Type Certificate Number	Performance Figures Guaranteed?	
107	93	35				37			Wl-ST	Wd-F	Yes	SPD	Ex	O-S	26		Advance—Waco Siemens
96	85	35			13 000	48	450	8	Wl-ST	Wd-F	Yes	SPD	Ex	O-S	15		Advance—Waco OX—5
115	105	40			15 000	76			Wl-ST	Wd-F	Yes	SPD	Ex	O-S	42		Advance—Waco Hisso
135	118	40	1 200		18 000	65		12	Wl-ST	Wd-F	Yes	SPD	Ex	O-S	41		Advance—Waco W—J—5
110	100	58	900		12 000	44	460	6 6	Wl-ST	Wd-F	Yes	SD	B	Arl	Apl	Yes	Aero-Craft—Coupe
130		39	1 080		17 000				Wl-ST	Wd F		SCD		RC	56		Alexander—Eaglerock A-1
100	87	34	514		11 500	48	435	10 3	Wl-ST	Wd F		SCD		RC	7	Yes	Alexander—Eaglerock A-2
121		40	840		14 700				Wl-ST	Wd-F		SCD		RC	58		Alexander—Eaglerock A-3
101	85	50	575	45	12 000	42	425	7 5	Wl-ST	Wd-F	Yes	SPD	Ex	RAR	17	Yes	American Eagle
105		36	680		15 200				Wl-ST	Wd F		S		RC			Arrow—Sport
150	110	45	1 190	12	18 000	120	500	32	Wd-P	Wd F	Yes	DeCD	S-B	Hy-C		Yes	Bach—Air Yacht
128	110	48	850		13 000	92	800	10	Wl-ST	Wd-F	Yes	SCD	Yes	RC	47		Bellanca—CH
105	95	41	450	40	13 000	37	400	8	WEST	Wd F	Ex	SPD	Ex	O-S	39	5%	Berliner—CM-4
136	110	45				60	550	12	Wl-ST	Wd-F	Ex	SPD	B	O-S	Apl	5%	Berliner—CM-5
60	90	30	460	60	10 000	35	325	9	Wl-ST	Wd-F	Yes	SC PD	Ex	RC	Apl	Yes	Bird Wing—No 6
132		57	800	16 5	15 100	140		25	Wl-ST	Wd-F	Yes	S	S	O	27		Boeing—40-B
129		57	800	25 5	12 000	140		20	Wl-ST	Wd F	Yes	S	S	O	54		Boeing—40-C
115		59	1,000	18 5	12 000	80		20	Wd	Wd F	Yes	Ds					Boeing—B-1E
95		52			12 000	40			Wd	Wd-F	Yes	DeD			23		Boeing—B-1D
110	90	60			12 000	37 5		6 5	Wl-ST	Wd F		SPD		RD	Apl		Bourdon Kitty Hawk
120	115	43	800		15 500	80	550	9 5	Wl-ST	Wd-F				RC			Breese
120	95	50		45	13 500	70		15	Wl-ST	Wd-F	Yes	SC	Yes	OS	53		Buhl Airsedan
139	115	45	800	15	14 000	90	700	14	Wl-ST	Wd-F	Yes	SP	Yes	OS	48	5%	Buhl Special Airsedan
110	60	40	800	25	11 000		800	7	Wl-ST	Wd-F	Yes	SP	Yes	OS	Apl	5%	Buhl Junior Airsedan
125	110	45—50	1 000			42	400	10	Wl-ST	Wd-F	Yes	SPD	Ex	RAR	Apl	5%	Cessna Aircraft Co
125	115	45	1 000			42	400	10	Wl-ST	Wd F	Yes	SPD	Ex	RAR	Apl	5%	Cessna Aircraft Co
150	125	45—50	1 400			42	400	12	Wl-ST	Wd PF	Yes	SPD	Ex	RAR	Apl	5%	Cessna Aircraft Co
104	85	36	550		10 000		400		Wl-ST	Wd PF	Yes	S	No	RC	53		Command-Aire
95	64	47			18 000	40	500	6	ST Wd	Wd F	No	D		RC	No	5%	Crawford Af
110	90	35	750	45	14 000	27	400	6	Wd	Wd F	No	SD	No	Grs	Apl	Yes	Crown—B3
101	85	46	400		11 500	50	607	7	Wl-ST	Wd-FD	Yes	S-PC	No	RAR	40	5%	Curtiss—Robin
85	75	46	560		15 000	15	375	3	Wl-ST	Wd-FD	Yes	SC	No	RAR	15	5%	Driggs—Dart II
96	80	25	590		10 000	20	400	4	Wl-ST	Wd F	Yes	SC	No	Elias			Elias—Aircoupe
105	90	40	700		10 500	30	425	5	Wl-ST	Wd F	No	SC	Yes	OS	Apl	Yes	Fairchild—21
130	104	50	800		12 400	70	800	12	Wl-ST	Wd F	Yes	SC	Yes	OS	Apl	Yes	Fairchild—41
158	110	55	1 050		17 500	160	800	21	Wl-ST	Wd F	Yes	SC	Yes	OS	89	Yes	Fairchild—71
125	105	40				84	750	10	Wl-ST	Wd	Yes	SC	Yes	Arl			Federal Aircraft—CM-1
118	98	48	500	40	11 500	78	800	12	Wl-ST	Wd P	Yes	SCD	Yes	RC	9		Atlantic—Fokker Univ
140	118	42	1,000	15	19 000	120	700	20	Wl-ST	Wd P	Yes	SCD	Yes	RAR	Apl	5%	Atlantic—Super Univ
148	125	55	1,400	10	16 000	286	580	60	Wl-ST	Wd-P	Yes	DeCD	Yes	RAR			Atlantic—Fokker F-10
115	95	35	800	14	16 000	56	500		DE-F	Wd F	Yes	SCP	Ex	O-S	Apl	5%	Gates—Day—New Standard
110	85	35	500		16 000		400		Wl-ST	Wd F	Yes	DeD	B	O			Gillis—Crusader
135	115	50	1 180	20	16 000	140	800	21	D-cor	D-cor	Yes	De	No	Arl		5%	Hamilton—H-45
140	120	53	1 000	16	16 000	140	800	23	D-cor	D-cor	Yes	De	Yes	Arl		5%	Hamilton—H-47
70	65	32	200			5 5	120		K ST	Wd-F	No	SC	No	RC			Heath—Parasol
120	87	35	500		10 500	46	450		Wd	Wd F	Yes	S	Ex	O	35		International—F-17
125	110	40	800		14 000	67	500		Wd	Wd F	Yes	S	Std	O	Apl		International—F-18
95	85	45	650	35	11 000	65	500	12	ST-D	Wd-F	Yes	SC	No	OC	Apl	5%	Ireland—Neptune
90	75	28	800	65	12 000	8	300	1 7	Wd	Wd-F	Yes	SC				6%	Irwin—M-T-2
151	130	57	1,150		17 400	500	750		Wl-ST				Yes				Keystone—Patrician
112		57	570				500		Wl-ST								Keystone—Pathfinder
120	110	55	600		20 000		800	7	Wl-ST	Wd F			S	Gr			Kinner—Courier
102		39	548		12 000		400		Wl-ST	Wd-F	Ex	SD	No	RC	19	5%	Kreider-Reisner—Challenger
130		40	1 350	10		60	800		DT-S	Wd-F		SFA					E M Laird—Commercial
125	105	40		15					Wl-ST	Wd F	Yes	DeD	Std	RC			Laird—Whippoorwill
100		35	600			42	400		Wl-ST	Wd-F					28		Lincoln—Page
155	110	55	1 000	16	15 000	100	700	10	W ood	Wd F	Yes	SC	H	RC	Apl	5%	Lockheed—Vega
167	135	55	1 460	10	17 250	100	800	16	W ood	Wd F	Yes	SC	H	RC	Apl	5%	Lockheed—Air Express
130	105	55			15 000	140	550	21	Wd-ST	Wd-T-D	Yes	DeD	O	O	54		Loening—Amphibian
126	108	49	1 000		16 000	65	700	10—11	Wl-ST	Wd F		SC	B	Grs	25	Yes	R F Mahoney—Ryan B1
150	120	48	1 250			150	1 800	16	Wl-ST D	D	Yes	DeDC	S	Arl			Metal—Flamingo
100	79	35	750						Wl-ST	Wd-F	Yes	S Pl		RAR			Mono Aircraft—Monocoupe
100	85	35	650		10 000	22	350	4	Wl-ST	Wd-F	No	S Pl	No	Grs	95	Yes	Mohawk—Pinto
85		50	925						Wl-ST	Wd-F			Std	RAR	Apl		Niles—Williams
90	80	55	500	25	12 500	50	400	9	Wl-ST	Wd-F	Ex	SPD	Sld	RC	56		Pheasant—H10
120	105	47	1 000		16 000	60	600		Wl-ST	Wd-F	Yes	S	Yes	Arl	18	5%	Pitcairn—PA-5
136	118	45				76			Wl-ST	Wd-F	Yes	S		Arl			Pitcairn—PA-6
101	82	45				35	800		Wl-ST	Wd-F	Yes	S		Grs			Pitcairn—PA-4
114	96	59	750		12 000	110	540	17	D-cor	D-cor	Yes	DeDC	Yes	F			Prudden—S-E-1
95		45				42			Wd D	Wd-F		DeCF					Richmond Airways—Sea Hawk
142	112	58	650		12 500	370	700	50	DOR-S	DOR-S	Yes	DeD	Hy	RDO	Apl	5%	Sikorsky—S37
125	110	55	860	15	15 400	200	500	36	Wd-D	DOR-S	Yes	DeD		DOS	60	5%	Sikorsky—S38 Amphibian
125	110	40	1 000	17	16 000	35	1 250	5 5	Wl-ST	Wd F	Yes	S				5%	Simplex—Red Arrow
104	85	30			15 000	40	400	5	Wl-ST	Wd F	Yes	SD		HyC			Starling
110	90	38	625		12 000	50	500	7	Wl-ST	Wd F	Yes	PC	St	RHy	Apl	5%	Stearman—C-3-K
120	105	55	1 000		16 000	65	620	11 5	Wl-ST	Wd F	Yes	PC	St	RHy	Apl	5%	Stearman—C-3-B
150	110	41	1 000		14 000	90	750	11	Wl-ST	Wd F	Yes	DeD	Std	Hy	74		Stinson—SM-1 D
110	95	46	800		13 500	48	550	7	Wl-ST	Wd F	Yes	Ds	Std	Hy	48	5%	Stinson—Junior
116	100	57	800	12 5	15 000	50	600	8	Wl-ST	Wd F	Yes	DS	Std	RC	73	Yes	Spartan—C-3
114	100	53			14 000	235	540	50	D-cor	D-cor	Yes	DeD	St	O			Stout—Ford—4AT
100		35	600			36	500		Wl-ST	Wd-F				RC	21		Swallow—Commercial
110	80	58	850			50	500	6	Wl-ST	Wd-F	Yes	SP		RAR		Yes	Taylor Bros Chummy
						50			Wl-ST	Wd-F		S					Texas—Temple
						120			D-cor	D-cor		Ds		Grs			Thaden Metal—T 1
114	95	40	800	20	15 000	43	440	10	Wl-ST	Wd F	Yes	SpeD	Ex	R	Apl	5%	Thunderbird W14-O
135	110	42	1 000	16	16 000	60	440	15	Wl-ST	Wd F	Yes	SpeD	Ex	R	Apl	5%	Thunderbird W14-H
100		42			12 000	42	410	6	Wl-ST	Wd-F	Yes	SPC	No	RC	30		Travel Air—2000
150		45			20 000	60		12	Wl-ST	Wd F	Yes	SPC	No	RC	32		Travel—4000
128	107	50	700		13 500	78	650	12	Wl-ST	Wd F	Yes	DeD	Yes	O	Apl		Travel Air—6000
105		42				66	650		Wl-ST	Wd F	Yes	SPC		RC	38		Travel Air—Siemens
95	82	40	670	37	11 000	28	500	5 25	Wl-ST	Wd F	Yes	SFD		Hy			Wallace—Touroplane
97	90	55	600		14 000	40	350	8	Wd W18	Wd F	No	S		C	Apl	5%	Whites—Humming Bird
95	85	30	600	20	12 000		500	8	Wl-ST	Wd F	No	SC D	No	RC	No	5%	Western—King Bird
100	85	33	000		20,000	300	1,000	20	Wl-ST	Wd-F	Yes	C	Yes	Arl		Yes	Zenith—Albatross

ND WING CONSTRUCTION
- P —Plywood cover
- R —Riveted
- S —Steel
- T —Tubing
- Wd —Wood
- Wl —Welded
- L —Lockheed
- O —Optional
- S —Sauzedde
- Std —Standard

LIGHTS
- N —Navigation lights

CONTROL
- A —Arens
- C —Cables
- D —Dual
- De—Wheel
- P —Push rods
- S —Stick
- Pl —Pedal

SHOCK ABSORBER
- Arl —Aerol
- C —Cord
- D —Compression
- Grs —Grass
- Hy —Hydraulic
- O —Oleo
- P —Pneumatic
- R —Rubber
- RAR—Rusco Aero Rings
- S— —Coil Spring
- T —Trombone

PONTOONS
- D —Duralumin
- E —Edo
- F —Fairchild
- H —Hamilton
- M —All metal
- W —Wood

TYPE CERTIFICATE
- Apl —Applied for and is pending

GUARANTEE
- N —New

MANUFACTURERS' SPECIFICATIONS ON ENGINES AVAILABLE FOR COMMERCIAL USE AS COMPILED BY *AVIATION*

THE TABLE BELOW IS BELIEVED TO BE ACCURATE BUT *AVIATION* DOES NOT ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN

This table will appear monthly and corrections and suggestions are invited

AVIATION

The Oldest American Aeronautical Magazine

April 20, 1929

AERONAUTICAL ENGINEERING SECTION

CONTENTS

The High Altitude Airplane

The First of Two Articles Discussing Engineering Problems in the Design of an Airplane to Navigate in the Stratosphere

By B. V. KORVIN-KROUKOVSKY

PROGRESS of civilization is marked by an ever-increasing demand for rapid transportation, for the ability to cover greater distances in a shorter time. At first man could only walk and run, later he rode horses, then came sailing ships, then railroads, automobiles and finally airplanes. Now we are forced to look for means of increasing the speed of airplanes, particularly the speed over a long distance, of increasing the speed and at the same time increasing flying range. This is a difficult combination as the resistance of air increases rapidly with speed, and the use of a powerful engine to overcome it results in a large gasoline consumption and a short flying range. Air resistance, the beneficial force which gives lift to our wings and makes flight possible, now becomes our enemy, prevents us from increasing speed in a measure required by the progress of civilization. As we looked for means of reducing friction in developing railroads and automobiles, so now we must look for means of reducing air resistance.

Already great progress has been made in improving the shape of airplane parts, in streamlining to reduce the resistance, and it is reported that an airplane is being built in Germany consisting of but one large wing, with all parts creating parasite resistance, such as the fuselage, completely eliminated. Nevertheless the wings, which we cannot eliminate, offer large resistance. We can reduce the resistance by reducing the size of wings, but there is a limit for such a procedure. Heavy loading per square foot causes excessive speed during take-off and landing, requires very large flying fields and is a source of danger. While we want to reach a great speed flying between cities and continents, we want to slow down to a low, safe speed while starting off and coming to a terminal. We want to find some way to reduce the air resistance, and to reach a great speed without decreasing the size of our wings and without increasing our landing speed. And fortunately the very nature of the airplane and of the atmosphere in which it flies points the way of doing it.

The atmosphere is not homogeneous, the air has the highest pressure and density at the ground level, and both the pressure and the density rapidly diminish with the altitude. The curves of Fig. 1 show that at the altitude of 22,000 ft. the air is only half as dense as at the sea level, and that at the altitude of 78,000 ft. its density is reduced 25 times. The airplane, which by its very conception, is a machine capable of rising from the ground and of changing its altitude, can utilize the dense air at lower altitude for take-off and landing, and can utilize the reduced density of higher altitudes for reduction of air resistance and for increase in speed. In this paper we will consider how such a utilization is possible at the present state of aeronautical engineering, and what advantages we can derive therefrom. In this connection we will refrain from vain speculation as to what will be made possible by new inventions such as gas turbines and jet propulsions, and will consider only the present status of aeronautical engineering, and the improvements and devices which seem to be immediately available. There is no question that new inventions will follow as soon as their need is clearly established, but there is also no question that at early stages of the new development we will have to rely not on future, but on our present knowledge. It is essentially the purpose of this paper to consider what we can do with the means available at present, with only such improvements as appear to be within easy reach.

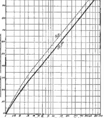


Fig. 1—Pressure and density ratio variation with altitude

The common way to handle an airplane on a cross-country flight is to take-off at a certain low speed, and at a certain large angle of incidence, to climb to a small altitude and then to reduce the angle of incidence by means of the elevator, thereby reducing the air resistance and increasing the speed. During the climb at a large angle of incidence comparatively small part of the engine power is needed for the sustention, and the excess of available power is used for the climb. In a horizontal flight, when the angle of incidence is reduced, this excess of power is used to overcome the extra air resistance produced by the increased speed. The maximum speed attainable in this way depends on the weight carried per horsepower and on the minimum speed of the airplane. The lower the minimum speed, the larger must be the wing area, the larger will be the air resistance, and the lower therefore will be the maximum speed. It has been shown by Diehl[1] that maximum speed of an airplane can be closely estimated by the formula

$$(1) \qquad V_{max} = K\eta^{1/3}\, V_{min}{}^{2/3} \left(\frac{W}{P}\right)^{-1/3}$$

where

V_{max} is the maximum speed in horizontal flight
V_{min} is the minimum, or stalling speed
W gross weight of airplane
P engine horsepower
η propeller efficiency
K numerical coefficient

For modern commercial airplanes we can assume

$$K\eta^{1/3} = 21$$

and formula (1) then becomes

$$(2) \qquad V_{max} = 21\, V_{min}{}^{2/3} \left(\frac{W}{P}\right)^{-1/3}$$

In order to put the discussion on a concrete basis, let us assume a typical six seater airplane with the following characteristics:

Gross weight	4,250 lb
Engine power	425 hp
Wing area	380 sq ft
Maximum lift coefficient	1.40
Minimum speed	55 m.p.h.

The maximum speed then works out as

$$V_{max} = 21 \times 55^{2/3} \times 10^{-1/3} = 141 \text{ m.p.h.}$$

In this paper we want to investigate a different method of handling an airplane, by which the initial large angle of incidence is not reduced but is kept constant, and the increase of speed is obtained by virtue of decreased air density as the airplane climbs to a high altitude. At present we will assume that a supercharger or some similar device maintains the engine power constant regardless of the altitude, and later we will investigate and justify the validity of this assumption. At a ground level our airplane can fly at a certain air speed V_o, slightly exceeding the minimum speed V_m and corresponding to the minimum power consumption P_o. Its wings develop the lift L equal to the weight of the airplane, and its resistance D is determined by its L/D ratio. The L/D ratio of an airplane depends only on its angle of incidence and does not depend appreciably on either speed or air density. In our case the angle of incidence remains constant during the climb, and therefore the L/D ratio also remains constant; the lift is always equal to the weight regardless of the altitude, and therefore remains also constant; from this it follows necessarily that *the drag also must remain constant*. As the airplane climbs, and the air becomes less dense with altitude, the speed of the airplane increases in order to maintain the same lift, and this increase of speed also serves to maintain the same drag. Turning to the mathematical expressions we can write for the airplane flying at a speed of minimum power consumption near the ground:

$$(3) \qquad L = \tfrac{1}{2}\rho_o V_o^2 C_L A$$

and at any other altitude

$$(4) \qquad L = \tfrac{1}{2}\rho V^2 C_L A$$

where:

L = lift equal to weight of the airplane
C_L = lift coefficient which is constant as long as the angle of incidence is constant
A = wing area
V = air speed at any altitude
V_o = air speed at ground level
ρ = air density at any altitude
ρ_o = air density at ground level.

Equating (3) and (4) and cancelling equal constant quantities we get

$$\rho_o V_o^2 = \rho V^2$$

or

$$(5) \qquad \frac{V}{V_o} = \left(\frac{\rho_o}{\rho}\right)^{1/2}$$

i.e., *as the airplane climbs at a constant angle of incidence its speed increases in inverse proportion to the square root of air density.* The power required is obtained by multiplying the drag by the air speed, and as the drag in this case remains constant *the power required is directly proportional to the air speed, and therefore is inversely proportional to square root of the air density*, i.e.

$$(6) \qquad \frac{V}{V_o} = \frac{P}{P_o} = \left(\frac{\rho_o}{\rho}\right)^{1/2}$$

Expressions (5) and (6) allow us to determine the ceiling and the speed range of the airplane equipped with some kind of a supercharger maintaining constant engine power at any altitude, and flying at a constant angle of incidence. We observe that in this case *the speed is directly proportional to the power*, and not to the cube root of the power as was the case when the flight at a constant altitude and varying angle of incidence was considered. This observation makes us expect that much higher speed may be attained by flying at a large angle of incidence at a great altitude, than flying at reduced angle of incidence near ground level.

It has been shown by E. P. Warner[2] that minimum power required for the maintenance of the horizontal flight at ground level can be estimated by the formula:

$$(7) \qquad P_o = \frac{W\sqrt{W/A}}{138}$$

Substituting this value of P_o in expression (6), and assuming the propeller efficiency equal to 0.85, which is justifiable in view of the large pitch necessary for the high altitude airplane, we get

$$(8) \qquad \frac{V}{V_o} = \frac{P}{P_o} = \frac{117}{\frac{W}{P}\sqrt{\frac{W}{A}}}$$

substituting:

$$\frac{W}{A} = \tfrac{1}{2}\rho_o V_o^2 C_L$$

[1] N.A.C.A. Technical Report No. 173

[2] E. P. Warner "Aerodynamics" Page 211.

and assuming the value of $C_L = 1.20$ as appropriate for the speed of minimum power consumption, evaluating $\rho_o = 0.00237$ and introducing the correction coefficient of $(22/15)^2$ so as to get the speed V in miles per hour we get

$$(9) \qquad \frac{V}{V_o} = \left(\frac{\rho_o}{\rho}\right)^{1/2} = \frac{2{,}120}{\frac{W}{P}V_o}$$

or finally

$$(10) \qquad V = \frac{2{,}120}{W/P}$$

This is a very interesting and important result, showing that if the airplane is kept at a constant angle of incidence, and the high speed is obtained by means of the climb to the altitude of greatly reduced air density *the maximum speed attainable is independent of the minimum speed*

The airplane with small wing area, high landing speed, and correspondingly high speed of minimum power consumption V_o, will not be able to climb very high, as shown by the value of the ratio ρ_o/ρ as obtained from (9) and its speed will be improved but little The airplane with large wing area will have very low speed V_{min} and V_o at the ground level, but it will be able to climb higher, and its speed will be improved much more *The maximum speed at the ceiling, however, will be the same in both cases, and will depend only on power loading W/P* We estimated above that a typical 425-hp airplane with a landing speed of 55 m p h, is able to attain the high speed of 141 m p.h at ground level Observing that $W/P = 10$ lb per hp we can estimate from (10) that were it kept at a large angle of incidence and made to climb to a high altitude *its maximum speed at the ceiling would be 212 m p.h, the improvement of 50 per cent over the ground level speed* Assuming the speed of minimum power consumption at sea level to be 60 m p h corresponding to the landing speed of 55 m p h., we obtain from (9)

$$\frac{\rho_o}{\rho} = \left(\frac{2{,}120}{10 \times 60}\right)^2 = 12.5$$

The corresponding altitude is found by consulting the curves of Fig 1 to be about *63,000 ft*

It is interesting to investigate the properties of the airplane which lead to the largest gain in speed at the altitude over that at ground level Dividing formula (10) by (2) and denoting by V_g the maximum speed at the ground level, by V_a the maximum speed at the altitude, and by V_m the minimum speed at the ground level, we get

$$(11) \qquad \frac{V_a}{V_g} = \frac{101}{\left(\frac{W}{P}V_m\right)^{2/3}}$$

This shows that the gain made possible by high altitude flying increases with the decrease of the landing speed, and with the decrease of the power loading The tendency towards decreased power loading is the predominating trend of aeronautical engineering, and every year we see more powerful engines, and lower loadings per horsepower Every year, therefore, the possible gain due to high altitude flying will increase, until it becomes too important to be neglected At the present time already a gain of 50 per cent can be expected, as has been shown by the example worked out earlier in this paper The tendency towards increased landing speeds can be also observed in the present trend of aeronautical engineering, but this can be considered only as a sacrifice in order to obtain higher maximum speed Such a sacrifice will be not necessary in the design of a high altitude airplane

Next we will consider the effect of high altitude flying on the range, or distance which the airplane can cover with its supply of fuel There are two distinct problems one—the limiting range of record breaking airplanes, and second—the normal range of service airplanes The record breaking airplane flies at about the constant angle of incidence at which its L/D ratio is the best In this respect it is similar to the high altitude airplane The difference lies in the fact that as fuel is consumed, and lighter weight leaves the excess of available power, this power in a high altitude airplane is used for the climb, while in ordinary method of control the engine is throttled in order to economize the fuel As in both cases the angle of incidence, and the L/D ratio remain constant the range can be estimated by Breguet's equation

$$(12) \qquad \text{Range in miles} = 863.5\left(\frac{L}{D}\right)\left(\frac{\eta}{C}\right)\log_{10}\left(\frac{W_o}{W_1}\right)$$

where

W_o = initial gross weight in pounds
W_1 = final gross weight in pounds
η = propeller efficiency at cruising speed
C = average specific fuel consumption

It will be shown later that in a high altitude airplane, geared engines probably will be used and that the propeller always will operate at a constant and a very high efficiency, which we can estimate at least at 80 per cent The engine runs nearly at full throttle and the specific fuel consumption can be taken at about 0.55 lb per hp -hr Thus we get

$$\eta/C = 0.80/0.55 = 1.45$$

In an airplane operated at a low altitude and with varying throttle openings, the propeller is usually not geared and its efficiency never exceeds about 70 per cent The specific fuel consumption also varies from 0.55 lb per hp -hr at full throttle at the beginning of the flight, to 0.75 lb per hp at half throttle at the end of it, average fuel consumption being about 0.65 lb per hp Using these figures we get

$$\eta/C = 0.70/0.65 = 1.08$$

Thus we see that while the same law governs the record range of a common and a high altitude airplane, the details of the propeller efficiency and of fuel consumption give the latter the advantage of 1.45/1.08, or about 35 per cent improvement in the range

In the above discussion we assumed the airplane set out to break the distance record, and flying therefore at the best L/D ratio and at a low speed In ordinary cases, on runs of from 300 to 600 mi, airplanes are not flown at such a low speed, and under "cruising" speed is usually meant an arbitrary reduced speed adopted in order to save the engine Usually it is between 75 per cent and 85 per cent of high speed The range at such an arbitrary "cruising" speed is evidently proportional to the range at high speed, and the high altitude airplane showing 50 per cent improvement of speed for the same engine power, will show equal improvement in the service range, i e., if it is considered practical to break the route of a low flying airplane into 500 mi runs, these runs can be increased to 750 mi for the high altitude airplane

We have shown that flying at a very high altitude will

allow us to increase the speed some 50 per cent at the power loading used on present-day commercial airplanes, and that this gain over the maximum speed possible at sea level will increase further as the power loading will decrease with the development of more powerful and lighter engines We have shown that this increase of speed will be accompanied by an increase of the range, thus reducing the necessary number of stops on long routes, and thereby increasing the average speed still more Moreover we have shown that this increase of high speed will not be obtained at the sacrifice of landing speed, as it is at present, and that there will be no objection to keeping the landing speed as low as desired for safety, and in order to use landing fields of moderate size These are the basic advantages of the high altitude airplane, but they are not the only advantages Improved safety, comfort of the passengers, ease of navigation, etc., are other important advantages However we will postpone the discussion of these, until we will advance further proofs that high altitude flying

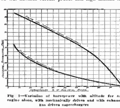


Fig 2—Variation of horsepower with altitude for an engine alone, with mechanically driven and with exhaust gas driven superchargers

is feasible So far we have spoken only about its advantages and merely assumed that it will be possible

The possibility of high altitude flying depends on two basic requirements, first—the provision of an airtight cabin in which the normal air density and temperature can be maintained despite the greatly reduced density and temperature of the surrounding atmosphere, and second—the arrangement of the power plant which will permit its operation in the extremely rarified and cold air We will consider the question of the power plant first as we must first prove the technical possibility of climbing to high altitude and after that only need to consider the accommodation of the crew

The horsepower of a plain, unsupercharged aviation engine decreases rapidly with altitude The weight of the air entering the cylinders decreases as the density of the air decreases and so does the indicated horsepower The friction losses, however, remain about the same regardless of the density, and these must be subtracted from the decreasing indicated horsepower This makes the engine torque decrease more rapidly than the density of the air decreases, i e, more rapidly than the torque of the propeller decreases at any given r p m The r p m of the engine thus decrease as the airplane climbs, and this decrease of r p m causes further loss of brake horsepower Several engines have been tested in the altitude chamber of the Bureau of Standards at the low atmospheric pressure and temperature closely simulating the conditions found at the altitudes. It has been found[8] that relation of the power to the density can be approximated by the expression

$$HP = (\rho/\rho_o)^{1.4}$$

The variation of the horsepower with altitude calculated by this formula is plotted in Fig 2 It will be observed that at the altitude of 20,000 ft only about 41 per cent of the original horsepower is available and at 45,000 ft only 10 per cent is available

As the decrease of engine power occurs due to decrease in density it is evident that it can be prevented by compressing the air, and maintaining the ground pressure at the carburetor A good deal of work has been done on the development of superchargers in all countries, and three distinct types have been evolved and brought to sufficient perfection for practical use These types are the Roots Supercharger driven at moderate speed by a pair of gears from the engine crankshaft, the centrifugal supercharger driven at a very high speed by means of a gear train from the engine crankshaft, and the Turbo compressor, or the centrifugal supercharger driven by a turbine operated by exhaust gases The first two types are identical in that the power needed to compress the air is taken from the crankshaft and should be subtracted from the brake horsepower of the engine causing the reduction of the horsepower with altitude, although not as large a one as in case of the unsupercharged engine The work needed to compress the air adiabatically is expressed as

$$(13) \qquad HP_s = \frac{144}{33{,}000}\,\frac{n}{n-1}\,\frac{1}{K}\,pv\left[\left(\frac{p_o}{p}\right)^{\frac{n-1}{n}} - 1\right]$$

where

HP_s = Horsepower needed to drive the supercharger
n = The ratio of specific heat of gas at constant pressure to that at constant volume For the air $n = 1.405$
K = Efficiency of the supercharger including driving gears
p = Pressure of the air at altitude in lb per sq in
p_o = Pressure of the air at sea level
v = Volume of the air at pressure p in cu ft

The average aircraft engine consumes about ½ lb of gasoline per horsepower per hour, and requires for its proper functioning 12 times as much air theoretically, and about 15 times as much air practically Taking the density of the air in normal conditions as 0.07608 lb per cu ft the volume of the air required per horsepower per minute works out as

$$0.5 \times 15/0.07608 \times 60 = 1.64 \text{ cu ft}$$

The weight of the air needed for combustion of ½ lb of gasoline and for production of one brake horsepower does not change with altitude As the pressure p decreases the volume v increases proportionally, and the product pv remains constant as long as temperature remains constant The normal temperature at sea level is usually taken as 60 deg F, or 288 deg C absolute and in a "Standard Atmosphere" it decreases at the rate of 1.98 deg C per thousand feet up to the altitude of about 35,000 ft., after which it remains constant at 218

[8] E P Warner "Aerodynamics" Page 161

deg C abs or —68 deg F The quantities p, v and T are related by the law

$$pv = RT$$

substituting the figures found at normal geound conditions

$$p = p_o = 14.7 \text{ lb/sq in}$$
$$v = 1.64 \text{ cu ft.}$$
$$T = 288 \text{ deg C}$$

we get

$$pv = 0.084\,T$$

And substituting all these constants into equation **(13)**, we obtain the horsepower absorbed by the supercharger per brake horsepower of the engine as

$$(14) \qquad HP_s = \frac{0.00127}{K} T \left[\left(\frac{p_o}{p}\right)^{0.29} - 1\right]$$

All superchargers used at the present were developed with a single and practical purpose of improving the performance of military aircraft, and were designed therefore for the probable fighting altitudes up to about 20,000 ft At this altitude the pressure ratio p_o/p is only 2.18, and it is possible to design a supercharger as a single stage compressor with the efficiency as high as 70 per cent In this paper, however, we are considering the possibility of flying at a much higher altitude, somewhere between 50,000 and 100,000 ft, at which the pressure ratio varies from 9 to 95 It is practically impossible to obtain such a pressure ratio in a single-stage compressor, and we will assume that a three-stage compressor is used with correspondingly lower efficiency, for which 40 per cent may be assumed as a fair figure. Substituting the figure of 0.40 for K, multiplying the coefficient 0.00127 by three, and dividing the exponent 0.29 by three, we obtain finally the power absorbed per horsepower of the engine by a three-stage supercharger as

$$(15) \qquad HP_s = 0.0096\,T \left[\left(\frac{p_o}{p}\right)^{0.10} - 1\right]$$

This power has to be subtracted from the brake horsepower in order to obtain the net horsepower of the engine. However, the brake horsepower increases somewhat if the intake pressure remains constant due to supercharger, and the exhaust pressure decreases When an engine works at the ground level, the combustion chamber at the end of the exhaust stroke is filled with exhaust gases at slightly above atmospheric pressure. The fresh charge taken in on the intake stroke is somewhat less therefore than the displacement of the piston When the engine works at a high altitude in a very rarefied atmosphere, the pressure of the exhaust gases filling the compression chamber is also very low, and as soon as the exhaust valve is closed and the intake valve is open, the fresh charge from the supercharger rushes in and fills the compression chamber even before the intake stroke begins In the extreme case of the engine with the exhaust opening into an absolute vacuum, the volume of the fresh charge will be equal to the displacement of the piston plus the volume of compression chamber. As this volume in case of aircraft engines is equal to about 20 per cent of the piston displacement (5 to 1 compression ratio), the volume of the fresh charge will be increased by 20 per cent, and so the power output will be increased Experiments made on engines exhausting into the rarefied atmosphere[4] showed that brake horsepower increases 1.3 per cent per pound of pressure difference between the exhaust and the intake For the extreme case of the engine exhausting in vacuum we get

$$\Delta HP = 1.3 \times 14.7 = 19.1 \text{ per cent}$$

which checks well with the theoretical reasoning given above

The net horsepower of the engine equipped with mechanically driven three-stage supercharger maintaining the normal pressure of 14.7 lb per sq in at the carbureter, and exhausting into the atmosphere can be expressed as:

$$(16) \qquad \frac{HP \text{ at altitude}}{HP \text{ at ground}} = 1 + 0.013\,(p_o - p) - 0.0096\,T \left[\left(\frac{p_o}{p}\right)^{0.10} - 1\right]$$

The variation of the horsepower computed by means of this formula is plotted against the altitude in Fig 2 It will be observed that the horsepower is reduced to 65 per cent of the rated value at the altitude of 50,000 ft, and dwindles to nothing at the altitude of 100,000 ft We must conclude, therefore that *excellent as the mechanically driven superchargers are for the fighting aircraft operating at the altitude of 20,000 ft, they are useless for the purpose of high altitude aircraft designed to operate between the altitudes of 50,000 and 100,000 ft*

Now it remains for us to consider the action of a compressor driven by a turbine operated by exhaust gases, generally known as the "Turbo-Supercharger" Fig 3 shows the diagram of such a turbo-supercharger, which was originally invented by Professor Rateau, and

Fig 3—Photograph showing a modern type of turbo-supercharger installed in an Army airplane

was subsequently developed independently by himself in France, and by the U S Air Service and General Electric Co in America The action of this turbo-supercharger probably can be explained best by quoting from a discussion by the man responsible for its development in America—Dr S A Moss [5]

" . . . The exhaust-valve chambers are connected to an exhaust manifold, *a*, which supplies gases to nozzles that direct these gases onto a turbine-wheel, *b* The turbine-wheel drives the centrifugal compressor, *c*, which takes in and compresses air and discharges it to

[4] A C A Internal Comb Engine SubCommittee Report No 35

[5] S A E Transactions Vol 21 Part 1 Page 262

the carbureter, *d*, and thence to the intake manifold, *e*, of the engine as shown in Fig 4

At an altitude of 20,000 ft., the pressure of the atmosphere surrounding an airplane is about one-half of that at sea-level At an altitude of 35,000 ft, the surrounding atmospheric pressure is about one-quarter of that at sea-level. At these great altitudes, full-sea-level pressure is maintained in the exhaust manifold when such a supercharger is used Outside of the turbine-wheel, the reduced pressure due to the great altitude exists The exhaust-gases pass through the nozzles at a high velocity due to the pressure difference and impinge on the turbine-wheel This serves to compress the air from the low pressure at the great altitude to full sea-level pressure, which is maintained in the carbureter intake-manifold, so that the engine receives its charge at full sea-level pressure . . . "

Let us consider now the amount of power which can be obtained from the expansion of the hot exhaust gases from the pressure of 14.7 lb in the exhaust manifold to a reduced atmospheric pressure at a high altitude The work done by the expanding gas, as well as the work done on the gas in compressing it is expressed by formula **(13)**, and we merely have to examine the values of n and pv for the exhaust gas The mixture entering the cylinders of the engine consists roughly of 1 part of gasoline vapor by weight, 3 parts of oxygen and 12 parts of nitrogen The exhaust gases leaving the cylinders[6] consist of 1 part of water vapor, 3 parts

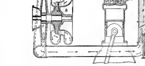


Fig 4—Diagram showing action of turbo-supercharger

of carbon dioxide and carbon oxide with some free hydrogen, and 12 parts of nitrogen This means that $\frac{4}{5}$ of the volume of the gas remains unchanged by passing through the engine and only $\frac{1}{5}$ changes into a slightly denser gas than air, very slightly denser because while the carbon dioxide is heavier than oxygen the part of which it replaced, the carbon oxide and the hydrogen are lighter We will make but a small mistake therefore if we will assume that exhaust gases when cooled to the normal temperature have the same volume of 1.64 cu.ft per horsepower per minute as the original mixture, and that relation

$$pv = 0.084\,T$$

found above for the fresh mixture, holds for the exhaust gas as well

In a similar way the coefficient of expansion n will have the same value of 1.405 for the exhaust gas as for the air The power available from the expansion of the exhaust gases can be determined therefore by formula (14), and the ratio of the power HP_s required to compress the air in a single-stage supercharger to the power HP_e made available by the expansion of the exhaust gases in the turbine works out as

$$\frac{HP_s}{HP_e} = \frac{Ta}{Te}$$

Where Ta is the absolute temperature of the surrounding air equal to 218 deg C at the altitudes above 35,000 ft and Te is the absolute temperature of the gases in the exhaust manifold, which can be taken as 1,000 deg C Substituting these figures we get:

$$HP_s/HP_e = 0.218$$

i.e., *the turbo-supercharger will be capable of compressing the air to normal pressure of 14.7 lb per sq in, at any altitude, provided its overall efficiency will be not less than 21.8 per cent* This figure can be further reduced by the use of a three-stage compressor. The power required to drive the three-stage compressor with no losses is expressed by

$$HP_s = 0.00381\,T_a \left[\left(\frac{p_o}{p}\right)^{0.10} - 1\right]$$

and the ratio of this power, to the power HP_e delivered by exhaust gases as determined by expression 14 is:

$$(17) \qquad \frac{HP_s}{HP_e} = 3\,\frac{Ta}{Te}\,\frac{(p_o/p)^{0.10} - 1}{(p^o/p)^{0.29} - 1}$$

This ratio is now dependent on the ratio p^o/p as well as on the ratio of temperatures Ta/Te For the same ratio of temperatures of 218/1,000, it works for the different altitudes as follows

at 50,000 ft.	$HP_s/HP_e = 0.182$
at 75,000 ft	$HP_s/HP_e = 0.159$
at 100,000 ft	$HP_s/HP_e = 0.138$

This decrease of the ratio HP_s/HP_e with altitude is a very beneficial feature, because it compensates for the increased amount of air which must be delivered to the engine in view of the decreasing oxygen content, the property of the atmosphere which we did not take into account before It is well known that air is a mechanical mixture of gases, mostly of the oxygen and nitrogen These two gases are not of the same density, but oxygen is slightly heavier than air and nitrogen slightly lighter The difference in density is small and in the lower layers of the atmosphere, below 35,000 ft., the air disturbances caused mostly by the variation of temperature, keep these gases well mixed Above the altitude of 35,000 ft the temperature is uniform, and the disturbances are absent, so the gases begin to separate because of the difference in their density, and the oxygen being the heaviest settles down. This causes larger oxygen content in the lower strata of the atmosphere and smaller content in the upper strata, the actual percentage content of the oxygen in the air varying as follows[7]

up to 35,000 ft	21 per cent
at 50,000 ft	20 per cent
at 75,000 ft	17 per cent
at 100,000 ft	15 per cent

As the percentage of the oxygen in the air decreases, the volume of the air to be supplied to the engine must be increased, increasing in the same proportion the power needed to drive the supercharger Taking this

[6] S A E Transactions Vol. 20 Part 2 Page 103.

[7] McAdie "The Principles of Aerography" Page 23

into account we obtain finally the following values for the ratio of HP_s/HP_e

at 50,000 ft.	19.1 per cent
at 75,000 ft	19.6 per cent
at 100,000 ft	19.3 per cent

On basis of these figures we can say that in order to supply air at normal pressure to the engine at any altitude *the turbo-supercharger must have the minimum overall efficiency of about 20 per cent* This figure appears to be quite modest and should not be difficult to attain

The fact that at altitudes above 35,000 ft or in the stratosphere, the miscellaneous gases gradually separate and tend to arrange themselves in order of their molecular weight, opens way to interesting speculation The atmosphere contains not only nitrogen and oxygen, but a considerable amount of hydrogen, which is almost absent in the lower layers of the atmosphere, and predominates in its upper layers As the percentage of oxygen decreases and the percentage of hydrogen increases with altitude, the proportion is reached at the altitude of about 200,000 ft., where their mixture is just correct for combustion Indeed, enormous explosions could have been caused by burning meteors, were it not for the fact that combustion is impossible when the mixture is as rarefied, as it is at the altitude of 200,000 ft. However, if this mixture were compressed by a supercharger and by the piston of an engine, it would burn very well and would supply the power necessary for flight Were an airplane built powerful enough to reach the altitude of 200,000 ft, it could remain there for indefinite length of time, and could cover any distance at a speed of some 3,000 m.p.h using atmosphere itself as a fuel To be able to do so, however, it must possess about 40 times the minimum power it requires for horizontal flight at sea level

So far we have considered only the question of the power required to drive the supercharger and of the net horsepower of the engine We reached the conclusion that ample power is available in the expansion of exhaust gases to supply the engine with air needed for full power consumption at all altitudes, provided that efficiency of the turbo-supercharger is not less than 20 per cent Now we will consider whether it is possible or practical to provide the supercharger equipment of sufficient size and if so, what will be the probable weight of it The existing superchargers built for use with a 400-hp engine, and capable of maintaining full pressure up to 20,000 ft add about 150 lb to the weight of the power plant The pressure ratio at 20,000 ft is equal to only 2.18, and the superchargers are built therefore as single-stage compressors with fairly high mechanical efficiency, and consume from 60 to 80 hp Now it is estimated elsewhere in this paper that the excess of power which a modern airplane possesses leads us to expect that an altitude of 75,000 ft. can be reached in a very near future From formula (15) we estimate that a supercharger needed to supply a 400-hp engine with air at such an altitude will require 336 hp, i.e., about 4 times the power of the existing superchargers It is a quite general rule of mechanical engineering that reducing the size of any mechanism makes all problems easier, while with increase of size all difficulties grow very rapidly There is little doubt that powerful gas turbines will be built in the future, but in the near future, with which alone we are concerned in this paper it is not probable that 336-hp gas turbine can be built Fortunately we do not have to do it, as we can get along quite well by using three or four superchargers of the existing size

The Rateau supercharger is shown in Fig 5, where (a) shows the inlet of exhaust gases, which must be connected to the exhaust manifold of the engine, (b) shows the outlet for exhaust gases from the turbine, (c) shows the air inlet and (d) the air outlet leading to the intake manifold of the engine It is quite possible to connect four turbines so that outlet of one is connected with the inlet of the other, and the exhaust gases expand successively through the four turbines The pressure ratio at the altitude of 75,000 ft is 29.2, and the expansion per turbine is

$$\sqrt[4]{29.2} = 2.32$$

i.e., quite reasonable. If the connecting manifolds are made short and well insulated in order to prevent heat losses, expansion of the gas can be considered to be almost adiabatic, and formula (14) can be applied In a similar way the four compressors will be connected

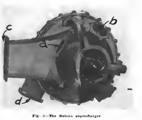


Fig 5—The Rateau supercharger

in series each one compressing the air 2.32 times, total compression being 2.32^4 or 29.2 times Contrary to the turbine connections, the compressor connections should be constructed so as to have plenty of the cooling surface exposed to the air stream so that heat generated by the compression in each stage can be dissipated

When we speak of the supercharger of existing size, we mean that vital parts such as the turbine wheel, the shaft and the impeller are of the existing size and type Of course there will be some difference in details, in particular in the number of nozzles through which the exhaust gases are directed onto the turbine wheel As the gases expand, the number or size of the nozzles in consecutive stages will have to be increased In a similar way the size of inlet connections in the compressors will have to be increased, and probably the impeller wheel will have to be made wider in the low pressure stage. Possibly it will be found expedient to increase the compression ratio per stage, reducing the number of stages to three, and assigning two turbo-compressors to handle the large volume of rarefied air in the first compression

stage, supplying it to single turbo-compressors of the second and third stages These, however, are details to be decided by the designer All that interests us now is the fact that it is not only possible, but comparatively easy to provide superchargers of sufficient capacity

The weight added by an early type turbo compressor was 150 lb for a 400-hp engine, which would make 600 lb for the four stage turbo-supercharger discussed above However, in combining four superchargers, some economies in weight may be effected, and we must allow for the improvements made as the time goes on, so that we can estimate the weight of complete turbo-supercharging equipment designed to work at the altitude of 75,000 ft at about one lb./hp., which is not prohibitive

In Part II, which will appear in the May 18 issue of the Aeronautical Engineering Section, of AVIATION, the problems of engine cooling, propeller selection and cabin design of the high altitude airplane will be discussed.

TECHNICAL REVIEWS

N.A.C.A. Technical Report No 305 The Gaseous Explosive Reaction, a Study of The Kinetics of Composite Fuels, by F W Stevens

This report deals with the results of a series of studies of the kinetics of gaseous explosive reactions where the fuel under observation, instead of being a simple gas is a known mixture of simple gases In the practical application of the gaseous explosive reaction as a source of power in the gas engine, the fuels employed are composite with characteristics that are apt to be due to the characteristics of their components and hence may be somewhat complex. The simplest problem that could be proposed in an investigation either of the thermodynamics or kinetics of the gaseous explosive reaction of a composite fuel would seem to be a separate study of the reaction characteristics of each component of the fuel and then a study of the reaction characteristics of the various known mixtures of those components forming composite fuels more and more complex This is the order followed in the simple studies herein described

N.A.C.A. Technical Report No. 297, The Reduction of Observed Airplane Performance to Standard Conditions, by Walter S Diehl

This report shows how the actual performance of an airplane varies with air temperature when the pressure is held constant This leads to comparatively simple methods of reducing observed data to standard conditions The new methods which may be considered exact for all practical purposes, have been used by the Navy Department for about a year, with very satisfactory results

The report also contains a brief historical review of the important papers which have been published on the subject of performance reduction, and traces the development of the standard atmosphere

N.A.C.A. Technical Report No 306 Full Scale Wind-Tunnel Tests of a series of Metal Propellers on a VE-7 Airplane, by Fred E Weick

An adjustable blade metal propeller was tested at five different angle settings forming a series varying in pitch The propeller was mounted on a VE-7 airplane in the 20 ft Propeller Research Tunnel of the National Advisory Committee for Aeronautics The efficiencies were found to be from 4 to 7 per cent higher than those of standard wood propellers operating under the same conditions The results are given in convenient form for use in selecting propellers for aircraft

N.A.C.A. Technical Report No 298 Effect of Variation of Chord and Span of Ailerons on Rolling and Yawing Moments in Level Flight by R H Heald and D H Strother

This report presents the results of an investigation of the rolling and yawing moments due to ailerons of various chords and spans on two airfoils having the Clark Y and U.S.A. 27 wing sections Some attention is devoted to a study of the effect of scale on rolling and yawing moments and to the effect of slightly rounding the wing tips

The results apply to level flight with the wing chord set at an angle of attack of +4 deg and to conditions of zero pitch zero yaw, and zero roll of the airplane It is planned later to extend the investigation to other attitudes for monoplane and biplane combinations

The work was conducted in the 10-ft wind tunnel of the Bureau of Standards on models of 60 in span and 10 in chord

Department of Commerce, Bureau of Standards Circular No 260, Soundproofing of Airplane cabins, by V. L Chrisler and W. F Snyder

The article contains a report of the work done in determining the structure which will give the maximum amount of sound insulation in an airplane cabin for a minimum weight

Various small structures were tested at frequencies varying from 150 to 1,120 cycles per second to determine the best structure available within the allowable limit of weight

A test flight was made in a treated cabin to determine how satisfactory the structure was under operating conditions It was found that the noise in the cabin was approximately the same as that in the interior of a rail way coach in motion

N.A.C.A. Technical Report No 302 Full Scale Tests on a Thin Metal Propeller at Various Tip Speeds by Fred E Weick

This report describes an investigation made in order to determine the effect of tip speed on the characteristics of a thin-bladed metal propeller The propeller was mounted on a VE-7 airplane with a 180 hp E-2 engine and tested in the 20 ft propeller research tunnel of the National Advisory Committee for Aeronautics It was found that the effect of tip speed on the propulsive efficiency was negligible within the range of the tests which was from 600 to 1,000 ft per sec (about 0.5 to 0.9 the velocity of sound in air)

Relative Lift Distribution In Any Biplane

By L. V. Kerber*

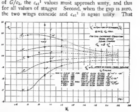
ACKNOWLEDGE of the distribution between the upper and lower wings of the total lift of a biplane is necessary in the solution of two airplane design problems, one of an aerostructural and the other of an aerodynamic nature. In the structural analysis of a biplane cellule, the relative loading on the wings has a marked influence on the stresses in the spars. In the computation of the performance of a biplane, the induced drag of the cellule is a main factor. Prandtl[1] has shown how it depends on the lift distribution, and gave particular solutions for minimum induced drag on the assumption that lift distribution is proportional to area distribution. A recent report[2] gave a general solution of Prandtl's equation for any lift distribution.

Numerous wind-tunnel tests of lift distribution have been made on models of equal-span, equal-chord biplanes with various combinations of gap/chord and stagger. With this empirical data as a basis, theoretical considerations permit a solution for biplanes with unequal spans and unequal chords, and with or without decalage. In the present report, charts are derived which yield quick solutions of the general cases. Three regimes of the polar are treated, that is, 25, 50, and 90 per cent of c_a[‡] maximum, important for the low incidence stress analysis case, for the determination of a representative value of the induced drag parabola coefficient, and for the high incidence stress analysis case, respectively. The relative loading on the upper and lower wings, e, is first given in graphical form for various values of s, the ratio of chords, and for r, the ratio of spans, equal to unity. Then a formula is derived which allows the introduction of r, less than unity. Finally, a graphical solution gives a correction to e for the effect of decalage. The variables are the ratio of the gap to the chord of the upper wing, r, s, stagger, decalage, and a, the proportion of the total lift contributed by the upper wing. The effect of variations in gap/span is considered as practically negligible, and the omission of this variable greatly simplifies the whole problem.

The Basic Data

In the past eight years, quite a number of isolated and limited tests have been made of the lift distribution in equal-span, equal-chord biplanes[3]. Lately, the N.A.C.A. published the results of a more systematic and comprehensive series of tests on an R.A.F. 15 biplane in which stagger and gap/chord were varied in rather wide limits. These data are plotted in Fig. 1, together with some of the earlier data, in the basic form of c_{a1}^1 in function of the ratio G/c_1 of the gap to the chord of the upper wing, and of the stagger. At any value of c_a of the biplane c_{a1}^1 is equal to the lift coefficient of the upper divided by the lift coefficient of the biplane.

The main difficulty was to fair the test data, which show a wide dispersion. The N.A.C.A. data were given more weight than the older sporadic tests on smaller models at lower test velocities. Two theoretical considerations simplify the fairing. First, at larger values of G/c_1, the c_{a1}^1 values must approach unity, and thus for all values of stagger. Second, when the gap is zero, the two wings coincide and c_{a1}^1 is again unity. That



this is true can also be deduced when the gap is taken smaller and smaller until the lower wing passes through the upper, when the gap may be considered negative. The upper wing now becomes the lower, and we must plot values of $c_{a2}^1 = 2 - c_{a1}^1$ (as in Fig. 1) on the left-hand side of G/c_1 = zero. The only possible continuous function is the one which passes through c_{a1}^1 = zero at G/c_1 = zero.

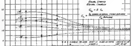
With these considerations in mind and by careful cross-plotting of the data for values of G/c_1 = constant, the curves of Fig. 1 were drawn as probably most representative of the actual conditions in an R.A.F. 15 biplanes. Figs. 2 and 3 incorporate similar data at other values of $c_a/c_{a\,max}$.

Values of c_a^1 derived from the data on e in the Air Corps Handbook for Designers[4] have been plotted in Figs. 1 and 3 for comparison with the new data and indicate, first, that they are just as inaccurate at high as at low values of c_a and, second, that the old experimental data had been improperly faired.

It is regretted that more extensive tests of the U.S.A. thick section No. 5 were not made, as the data observed at G/c = 0.9 not only do not check the R.A.F. 15 data, but the great change in c_{a1}^1 from stagger +30 deg. to zero stagger in comparison with the change from zero stagger to stagger —30 deg. appears highly improbable. Just why the relative loading at a certain c_a value should be expected to show any appreciable variation with the airfoil thickness or camber is not clear.

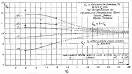
The Relative Loading

The relative loading is designated by e and is the ratio of the lift coefficient of the upper to the lift coefficient of



the lower wing. It is used directly in the stress analysis of wings. The present data are based on older tests on equal-span, equal-chord biplanes, but have been indiscriminately used for unequal chords and spans and for both the high and low incidence conditions. In this report empirical-theoretical data are given for 25 per cent and 90 per cent $c_{a\,max}$ for stress analysis purposes.

The relative loading can also be used to determine L_1/L, the lift of the upper wing divided by the total lift. This ratio has been designated a in A.C.I.C. #607. Strictly speaking, there is a different value of a all along the polar, so that the induced drag curve is the envelope of a family of parabolas. But induced drag is not an important factor at low c_a values, nor is it at high c_a values, which are outside the practical, economical flight range. However, at medium c_a values, where climbing occurs, the induced drag is a main factor, so that this report gives data on e and, hence, on a, for c_a equal to 50 per cent $c_{a\,max}$. It is intended that the parabola through this point be substituted for the above-mentioned



envelope curve, that is, that a in A.C.I.C. #607 be computed from values in this rrport of e at 50 per cent $c_{a\,max}$.

1. Equal Spans, Equal Chords ($r = 1$, $s = 1$)

In this simplest case, when the areas of the upper and lower wings are equal, e may be found from the basic data. The lift of the biplane is the mean of the lifts of the two wings.

Since

$$A_1 = A_2 = \frac{A}{2}$$

$$c_{a1} + c_{a2} = 2c_a \tag{1}$$

In a conventional biplane having equal chords and equal spans, A_1 will be greater than A_2 owing to the portion of the wing cut by the fuselage. The problem is greatly simplified by neglecting this effect, which is considered negligible.

By definition,

$$c_{a1}^1 = \frac{c_{a1}}{c_a}$$

$$c_{a2}^1 = \frac{c_{a2}}{c_a}$$

Then,

$$c_{a2}^1 = 2 - c_{a1}^1 \tag{2}$$

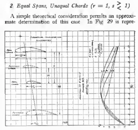
and

$$e = \frac{c_{a1}^1}{c_{a2}^1} = c_{a1}^1/(2 - c_{a1}^1) \tag{3}$$

c_{a1}^1 is taken from Figs. 1, 2, and 3; e is computed from Equation (3) and plotted in Figs. 5, 13, and 21.

2. Equal Spans, Unequal Chords ($r = 1$, $s \gtrless 1$)

A simple theoretical consideration permits an approximate determination of this case. In Fig. 29 is repre-



sented such a biplane in which $c_2/c_1 = s = 0.5$. The problem is to estimate the effect of the lower on the upper wing and of the upper on the lower wing. Since the lift is directly proportional to both area and circulation and since the circulation velocity varies inversely with the distance from the disturbing wing, the same disturbance velocities result at the upper wing from the circulation around a fictitious lower ring with twice the chord (hence, twice the area of the real lower) and twice as far away from the upper as is the real lower. So, if we want to find c_{a1}^1 for $G/c_1 = 1.0$ when $s = 0.5$, we must take c_{a1}^1 from Fig. 1[5] at $G/c_1 = 2.0$, since we now have to consider a biplane of equal span and equal chord but with twice the gap. Similarly, the effect of the upper on the lower can be approximated by placing a fictitious upper with half the chord of the real upper at half the real gap away from the lower. To find $c_{a2}^1 = 2 - c_{a1}^1$, we take c_{a1}^1 from Fig. 1[6], but at the original G/c_1. In general, we take

*Guggenheim Professor of Applied Aeronautics, University of Michigan. Chief, Engineering Section Aeronautics Branch, Dept. of Commerce.

[1]N.A.C.A. Technical No. 182

[2]"The Induced Drag of Any Biplane", A.C.I.C. No. 607

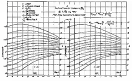
[3]See Fig. 1 for references

‡For Symbols see Page LXV

[4]From which Fig. 2 Bulletin 14, Aeronautics Branch, Department of Commerce, is a reprint.

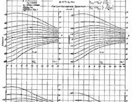
[5, 6](Or from Figures 2 or 3, as the case in point may be.)

$c_{a1}{}^{1}$ from Fig. 1[7] at real $G/c_1/s$, and $c_{a2}{}^{1} = 2 - c_{a1}{}^{1}$ from Fig. 1[8] at real G/c_1. e may then be computed as $c_{a1}{}^{1}/c_{a2}{}^{1}$. Results are plotted in Figs. 4 to 28 inclusive. By following the same line of reasoning, the same results are obtained for the case of the lower wing having a larger chord than the upper wing, $s > 1$



In Fig. 30 e is plotted for stagger = constant and for various values of $s < 1$ and of G/c_1

It should be noted that a secondary effect has been neglected. The curvature of the streamlines at the upper wing due to the presence of the fictitious lower is less than that due to the true lower. As a consequence,



the increase in lift of the upper in presence of the real lower is greater than in the presence of the fictitious lower. But the negative curvature of the streamlines at the lower due to the fictitious upper is greater than that due to the real upper, and the lift of the lower decreases more slowly in presence of the real upper than in the presence of the fictitious upper. Since we have a slight increase in both numerator and denominator, the value of the quotient e is not greatly changed, and the method of this section of the report gives a good approximation to actuality

3 Unequal Spans, Unequal Chords ($r \gtrless 1$, $s \lessgtr 1$)

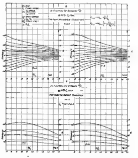
For the solution of this case, it is assumed that the portion of the upper wing directly above the shorter lower wing is affected in the same manner as if b_1 were equal to b_2 (that is, as if r were 1) and that the overhanging portion of the upper span is unaffected. Then, e for $r < 1$ becomes

$$e_{r<1} = \frac{r\, c_{a1}{}^{1} + (1 - r)}{c_{a2}{}^{1}}$$

$$= \frac{r\, c_{a1}{}^{1}}{c_{a2}{}^{1}} + \frac{1 - r}{c_{a2}{}^{1}}$$

$$e_{r<1} = r\, e\,(r = 1) + \frac{1 - r}{2 - c_{a1}{}^{1}} \qquad (4)$$

When the span of the lower wing is greater than the



span of the upper, r is greater than unity, and we have

$$e(r > 1) = r\, e(r = 1)\left[1 - \frac{r - 1}{c_{a2}{}^{1} + r - 1}\right] \qquad (4^1)$$

The effect of Decalage

The relative loading

$$e_d = \frac{c_{a1d}}{c_{a2d}}$$

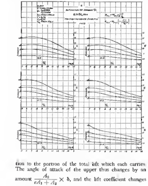
when decalage is introduced into the cellule can be evaluated by writing the expressions for the numerator and denominator in terms of the decalage δ, a mean slope of the biplane lift curve $\frac{dc_a}{d\alpha}$, the ratio $\frac{L_1}{L} = a$

[7, 8] (Or from Figures 2 or 3 as the case in point may be.)

and the values of $c_{a1}{}^{1}$ and $c_{a2}{}^{1}$ for δ = zero. Thus,

$$e_d = \frac{c_{a1d}}{c_{a2d}} = \frac{c_{a1}{}^{1} c_a + \delta \frac{dc_a}{d\alpha} c_{a1}{}^{1}\left(\frac{A_2}{eA_1 + A_2}\right)}{c_{a2}{}^{1} c_a - \delta \frac{dc_a}{d\alpha} c_{a2}{}^{1}\left(\frac{eA_1}{eA_1 + A_2}\right)} \qquad (5)$$

This is derived by considering that the total decalage is distributed between the two wings in inverse propor-



tion to the portion of the total lift which each carries. The angle of attack of the upper thus changes by an amount $\frac{A_2}{eA_1 + A_2} \times \delta$, and the lift coefficient changes by $c_{a1}{}^{1}\frac{dc_a}{d\alpha}$ times that amount. $c_{a1}{}^{1}c_a$ is equal to the lift coefficient, c_{a1} of the upper when no decalage is present. But

$$\frac{eA_1}{eA_1 + A_2} = a = \frac{L_1}{L}$$

Substituting and simplifying,

$$e_d = e\left[\frac{1 + \delta\,\frac{dc_a}{d\alpha}\,\frac{(1 - a)}{c_a}}{1 - \delta\,\frac{dc_a}{d\alpha}\,\frac{a}{c_a}}\right]$$

This can also be written

$$\frac{e_d}{e} = \left[\frac{1 + \dfrac{\delta\,(1 - a)}{c_{a\,max} \times \text{per cent } c_{a\,max}}}{1 - \dfrac{\delta\,a}{c_{a\,max} \times \text{per cent } c_{a\,max}}}\right] \qquad (7)$$

A mean value of $\frac{dc_a}{d\alpha}$ for biplanes of 0.000175 has been assumed and Equation (7) plotted in Fig. 28 for values of decalage of ± 2 deg. in function of $c_{a\,max}$ times per cent $c_{a\,max}$, and a. It was necessary in the determination of a to use the value of the relative loading, e, when δ was zero. This introduces an error of ± 2 per cent in extreme cases. If this error is considered too great, a second approximation may be made, taking

$$a = \frac{e_d A_1}{e_d A_1 + A_2} \qquad (8)$$

A third approximation is entirely unnecessary

Symbols

The following symbols are used in this paper:

$A = A_1 + A_2$

A_1 = Effective area of upper wing; A_2 = Effective area of lower wing — These areas include 50 per cent of fuselage and 25 per cent of nacelles

a = Portion of total lift contributed by upper wing

b_1 = Span of upper wing

b_2 = Span of lower wing

c_1[9] = Chord of upper wing — (Mean aerodynamic)

c_2[10] = Chord of lower wing — (Mean aerodynamic)

c_a = Lift coefficient of the biplane; c_{a1} = Lift coefficient of the upper wing in the biplane; c_{a2} = Lift coefficient of the lower wing in the biplane — lbs./sq. ft./m.p.h.

$c_{a1}{}^{1} = c_{a1}/c_a$

$c_{a2}{}^{1} = c_{a2}/c_a$

$e = c_{a1}/c_{a2}$

e_d = e decalage

G[11] = Gap (Aerodynamic)

L = Lift of the biplane

L_1 = Lift of the upper wing in the biplane

r = Span ratio, b_2/b_1

s = Chord ratio, c_2/c_1

Stagger[12] = Angle measured between a line connecting the third points of the mean aerodynamic chords of the upper and lower wings, and a line perpendicular to the mean aerodynamic chord of the upper wing

δ = Angle of decalage

Determination of "e"

The value of "e," the relative efficiency of the upper wing with respect to the lower wing for the four possible combinations of chords, spans and decalage, is obtained in the manner indicated for each case.

Case I—Equal spans, equal chords, no decalage

$r = 1$

$s = 1$

e is taken directly from Figs. 5, 13, or 21, as the case may be

Case II—Equal spans, unequal chords, no decalage

$r = 1$

$s \gtrless 1$

e is taken directly from Figs. 4 to 27, as the case may be

[9, 10, 11, 12] The chords, gap and stagger used are the mean aerodynamic values although the physical mean arithmetic values would be more nearly correct. This deviation is warranted by the fact that differences are negligible, and the necessity of dealing with two sets of values is eliminated

Case III—Unequal spans, unequal chords, no decalage.

$$r \gtrless 1$$

$$s \gtrless 1$$

1. Determine e for $r = 1$ from Figs. 4 to 27, as the case may be.
2. Determine $c_{01}{}^1$ from Figs. 1, 2, or 3, as required.
3. Determine e for $r \gtrless 1$ from the following relations:

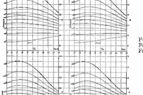
a. $e(r < 1) = r \cdot e(r=1) + \dfrac{1-r}{2-c_{01}{}^1}$

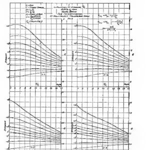
b. $e(r > 1) = r \cdot e(r=1) \left[1 - \dfrac{r-1}{1-c_{01}{}^1+r} \right]$

Case IV—Case I, II, or III with decalage.

1. Determine e for no decalage as above.
2. Calculate a for no decalage from $a = \dfrac{eA_1}{eA_1 + A_2}$
3. Determine $\dfrac{e_d}{e}$ from Fig. 28.
4. Calculate e_d from Equation (3) (first approximation).
5. Recalculate a from $a = \dfrac{e_d A_1}{e_d A_1 + A_2}$
6. Determine $\dfrac{e_d}{e}$ from Fig. 28.
7. Calculate e_d from Equation 6 (second approximation).

(For use in charts of A.C.I.C. 607, the second approximation for a must be used.)





Examples

The lift distribution in representative biplane cellules is solved in the following according to the formulas and charts of this paper.

Case I—Equal spans, equal chords, no decalage.

Span—Upper wing	$= 40$ ft. (b_1)
Span—Lower wing	$= 40$ ft. (b_2)
Chord—Upper wing	$= 60$ in. (c_1)
Chord—Lower wing	$= 60$ in. (c_2)
Gap	$= 60$ in. (G)
Stagger	$= +15$ deg.
$r = b_2/b_1$	$= 1$
$s = c_2/c_1$	$= 1$
$G/c_1 = 60/60$	$= 1$

From Fig. 5, $e = 1.193$ (Low incidence).
From Fig. 13, $e = 1.251$ (High incidence).
From Fig. 21, $e = 1.210$ (For determination of equivalent monoplane span).

Case II—Equal spans, unequal chords, no decalage.

Span—Upper wing	$= 40$ ft. (b_1)
Span—Lower wing	$= 40$ ft. (b_2)
Chord—Upper wing	$= 60$ in. (c_1)
Chord—Lower wing	$= 30$ in. (c_2)
Gap	$= 60$ in. (G)
Stagger	$= +15$ deg.
$r = b_2/b_1$	$= 1$
$s = c_2/c_1 = 30/60$	$= 0.5$
$G/c_1 = 60/60$	$= 1$

From Fig. 10, $e = 1.121$ (For low incidence).
From Fig. 18, $e = 1.150$ (For high incidence).
From Fig. 26, $e = 1.132$ (For determination of equivalent monoplane span).

Case III—Unequal spans, unequal chords, no decalage.

Span—Upper wing	$= 40$ ft. (b_1)
Span—Lower wing	$= 20$ ft. (b_2)
Chord—Upper wing	$= 60$ in. (c_1)
Chord—Lower wing	$= 30$ in. (c_2)
Gap	$= 60$ in. (G)
Stagger	$= +15$ deg.
$r = b_2/b_1 = 20/40$	$= 0.5$
$s = c_2/c_1 = 30/60$	$= 0.5$
$G/c_1 = 60/60$	$= 1$

From Fig. 10, $e(r = 1) = 1.121$ (For low incidence).
From Fig. 1, $c_{01}{}^1 = 1.090$ (For equal chords and equal spans)

$$e\,(r<1)\ re\,(r=1) + \frac{1-r}{2-c_{01}{}^1}$$

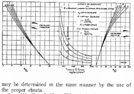
$$= 0.5 \times 1.121 + \left(\frac{1-0.5}{2-1.090}\right)$$

$$= 0.560 + \frac{0.5}{0.910}$$

$$= 560 + 0.549$$

$e\,(r < 1) = 1.109$ for the low incidence condition.

The value of e for the high incidence condition and for the determination of the equivalent monoplane span



may be determined in the same manner by the use of the proper charts.

Case IV—Case I, II, or III with decalage.

Area upper wing	$= 200$ sq. ft. (A^1)
Area lower wing	$= 45$ sq. ft. (A_2) (includes 50 per cent fuselage and 25 per cent nacelles)
Span upper wing	$= 40$ ft. (b^1)
Span lower wing	$= 20$ ft. (b_2)
Chord upper wing	$= 60$ in. (c_1)
Chord lower wing	$= 30$ in. (c_2)
Gap	$= 60$ in. (G)
Stagger	$= +15$ deg.
Decalage	$= +1.5$ deg.

The above characteristics are identical with Case III, decalage excepted.

$e = 1.109$ (no decalage) (from Case III, low incidence)

$$a = \frac{eA_1}{eA_1 + A_2}$$

$$= \frac{1.109 \times 200}{(1.109 \times 200) + 45} = \frac{221.8}{221.8 + 45} = \frac{221.8}{266.8}$$

$a = 0.832$

$\dfrac{e_d}{e} = 1.46$ (from Fig. 28 at $c_a = 0.0008 = 25$ per cent $c_{a\,max}$)

$e_d = 1.109 \times 1.46 = 1.620$ (first approximation)

$$a = \frac{e_d A_1}{e_d A_1 + A_2} = \frac{(1.62 \times 200)}{1.62 \times 200 + 45}$$

$$= \frac{324}{324 + 45} = \frac{324}{369} = 0.878$$

$\dfrac{e_d}{e} = 1.48$ (from Fig. 28 at $c_a = 0.0008$, 25 per cent $c_{a\,max}$)

$e_d = 1.48 \times 1.109 = 1.642$ (second approximation)

The value of e_d for the high incidence condition and for the determination of the equivalent monoplane span may be determined in a like manner, using the proper value of e, and the c_a in Fig. 28.

Summary

With experimental data on special biplane cellules as basis, the empirical-theoretical method of this paper permits the general solution for the lift distribution in any biplane. The determination of the relative loading e for stress analysis work is rationalized, and the effect of actual lift distribution on induced drag can be found from the data of this paper in conjunction with the charts of a previous report, A.C.I.C. 607, on "The Induced Drag of Any Biplane." The introduction of the variable gap/span into this problem is held to be unnecessary and undesirable. Sweepback, dihedral, and taper may be eliminated from the problem by dealing with mean aerodynamic chords of the two wings and with a mean value of the gap. It is believed that the data of this paper, although based solely on R.A.F. 15 biplane tests, may be considered valid for biplanes with airfoils of other thicknesses and cambers, at least until further systematic tests have been made which show differences due to airfoil section greater than the probable error of any one measurement.

TECHNICAL PUBLICATIONS RECEIVED

N.A.C.A. Technical Note No. 304, Corrosion Embrittlement of Duralumin V. Results of weather exposure tests, by Henry S. Rawdon, Bureau of Standards.

N.A.C.A. Technical Memorandum No. 505, Impact Waves and Detonation, by R. Becker. Part I. From Zeitschrift fur Physik, Volume VIII.

N.A.C.A. Technical Memorandum No. 504, Mechanical Control of Airplanes, by H. Boykow. From the 1927 yearbook of the Wissenschaftliche Gesellschaft fur Luftfahrt.

Department of Commerce, Bureau of Standards, Research Paper No. 48. Transmission of Sound Through Wall and Floor Structures, by V. L. Chrisler, associate physicist and W. F. Snyder, junior physicist.

Division of Simplified Practice, Department of Commerce, results and Benefits of applying Simplified Practice to Corbon Brushes and Brush Shunts, by H. P. Dalzell, Research Unit.

Royal Aeronautical Society. Airscrew-Body Interference. A paper by C. N. H. Lock, M. A.

PATENTS ISSUED

Patent No 1,703,488—*Start of Flying Machines Hugo Junkers, Dessau, Germany. One claim* The method of starting a flying machine having the usual landing gear but which is incapable of rising by its own power from the surface when heavily loaded, comprising combining such machine with an auxiliary flying machine, utilizing the combined power of both machines for attaining sufficient speed for lifting the machine to be started off the surface and to an altitude at which it is supported by the air to the extent of being able to soar and fly, and then separating the auxiliary flying machine, while continuing the flight of the started flying machine independently

Patent No 1,704,968—*Airplane Take-off William E Gale, Dallas, Texas One claim.*

Patent No 1,705,432—*Airplane Landing Apparatus Pliny Kilburn Westcott, Brooklyn, N Y, assignor to Mary A Kenney, Brooklyn, N Y Eight claims*

Patent No 1,705,489—*Helicopter-Type Flying Machine Frank Mladinich, New York, N Y Four claims*

Patent No 1,705,535—*Aeroplane, Frank L Riffert, Haubstadt, Inc Three claims*

Patent No 1,704,112—*Aircraft Wilhom Stelzer Chicago, Ill Twenty-one claims*

Patent No 1,704,449—*Flying Machine Julius Von Waldy, New York, N Y Twelve claims*

Patent No 1,703,621—*Flying Machine Alvah Haworth, Long Beach, Calif, by decree of distribution to Luella Haworth Six claims.*

Patent No 1,703,916—*Tunnel Airboat Karl Max Erich Zwinkel, Denville, N J Four claims*

Patent No 1,704,034—*Aircraft Provided with Rotating Wing Surfaces. Lucien Chauviere, Paris, France One claim*

Patent No 1,704,713—*Pontoon-Attaching Means Arthur Ralston Stalb, Jr, Farmingdale, N Y, assignor to Fairchild Aviation Corporation, New York, N Y Nine claims*

Patent No 1,705,896—*Landing Gear for Aeroplanes Harry T Booth, Freeport, N Y, assignor to Leonard W Bonney, Flushing, N Y, and Kirkham Products Co, Garden City, N Y Eleven claims*

Patent No 1,706,397—*Airship Eugene Brunner, Akron, O, assignor to Luftschiffbau Zeppelin Gesellschaft mit beschrankter Haftung, Friedrichshafen, Bodensee, Germany Two claims*

Patent No 1,706,414—*Airship Mooring and Transporting Device Beno Schnitzer, Akron, O., assignor to Luftschiffbau Zeppelin Gesellschaft mit beschrankter Haftung, Friedrichshafen, Bodensee, Germany Three claims*

Patent No 1,706,415—*Anchoring Device for Airships Beno Schnitzer, Akron, O, and Wilhelm E Dorr, Friedrichshafen, Germany, assignors to Luftschiffbau Zeppelin Gesellschaft mit beschrankter Haftung Friedrichshafen, Germany Seven claims*

Patent No 1,705,909—*Parachute Jennings De Witt, New York, N Y Three claims*

Patent No 1,706,830—*Dirigible Ralph H Upson, Birmingham, Mich, assignor to Aircraft Development Corporation, Detroit, Mich 48 claims* An airship of substantially circular cross-section, a rigid hull structure forming a segment extending the length of the ship and from the bottom part way up the sides, stiff longitudinal members extending on meridian elements along the roof of the hull and secured at their ends to the lower rigid segment, interconnecting circumferential ribs, and gas-tight strain-resisting metal sheathing confining and directly resisting the pressure of the buoyant gas, and enclosing the meridian longitudinal members and ribs

Patent No 1,706,457—*Airplane Drive Noah Moser, Long Beach, Calif Two claims*

Patent No 1,706,677—*Safety Attachment for Aeroplanes. Domenico Pallaria, London, Ontario, Canada. Three claims*

Patent No 1,706,956—*Auxiliary and Movable Wings to be Brought in Use on the Departure and the Landing of High-speed Aeroplanes Fernan Oscar Comll, Marseilles, France One claim*

Patent No 1,707,177—*Aeroplane George W Ray, Forty Fort, Pa, assignor to Marika Yonssoupovna, Kingston, Pa Three claims*

Patent No 1,704,325—*Internal-Combustion Engine and Working Same Hugo Junkers, Dessau, Germany Ten claims* The method of working free-flying piston engines, comprising causing the charge of air in the working cylinder to be compressed at least so far that it assumes the ignition temperature of the fuel, and thereafter introducing in positively timed relation in the cycle the non-ignited fuel into the air thus compressed within the cylinder near the inner dead center position of the piston so as to instantly burn each particle of fuel as it enters the cylinder

Patent No 1,704,612—*Aircraft Flotation Device. Frederick Hosmer Johnson, Kenmore, N Y Five claims*

Patent No 1,705,904—*Aeroplane Emry Davis, Clearwater, Fla Twenty-one claims*

Patent No 1,703,705—*Means for Determining Altitude Karl H Beij, Washington, D C Two claims*

Patent No 1,704,076—*Amphibian Aeroplane without Boat-Shaped Pontoons Edward R Carroll, Burlingame, Calif Two claims*

Patent No 1,705,346—*Airship Philip C Traver, Lynbrook, N Y, assignor of one-third to George E Wiedner and one-third to Leslie J Ekenberg, Far Rockaway, N Y Six claims*

Patent No 1,702,682—*Automatic Ground Release for Aeroplanes Charles D, Carey, Channing, Mich Five claims*

Patent No 1,703,222—*Aeroplane Landing Gear, Daniel J Brimm, Jr, West Hempstead, N. Y, assignor to Ireland Aircraft Inc Two claims*

Patent No 1,706,294—*Aircraft Covering Isadore M Jacobsohn, Chicago, Ill, and Starr Truscott, Birmingham, Ohio Two claims*

Let "Mr. Pioneer" Do It

If you don't know "Mr. Pioneer" and what his men can do for you, get acquainted with him. He is a member of the Pioneer Instrument Company Service Department.

Pioneer Service is world wide, and unlimited in scope. For example: On the night that Lindbergh landed at Paris, an industrious souvenir hunter carried away a part of the Earth Inductor Compass. Pioneer service men had repaired the damage the next day. More recently, a mid-western airplane manufacturer reported trouble with the Air Speed Indicator. A Pioneer Service Man soon overcame the difficulty by correcting a detail in the installation.

Instrument Counsel for Manufacturer, Pilot and Owner

Pioneer engineers are ever ready to help design an instrument board, locate a pitot tube correctly, or counsel with you on the proper instruments for your airplane.

Owner, pilot or airplane manufacturer . . . you should know "Mr Pioneer" Get in touch with him for instrument service or information.

The
PIONEER LINE

Air Distance Recorder
Air Speed Indicator
Altimeter
Batteries
Climb Indicator
Compass, Magnetic
Earth Inductor Compass
Engine Gauge Unit
Flares
Flight Indicator
Fuel Level Gauge
Fuel Pressure Gauge
Fuel Strainer
Hand Fuel Pump
Holt Flares
Lamps, Instrument
Landing Lights
Navigation Lights
Octant
Oil Pressure Gauge
Power Fuel Pump
Refueling Pump
Sextant
Speed and Drift Meter
Tachometer
Tachometer Shaft
Thermometer
Turn Indicator
Watch
Wiley Flares

PIONEER INSTRUMENT COMPANY
754 LEXINGTON AVE. BROOKLYN NEW YORK

10 SPEAR ST, SAN FRANCISCO

PROGRESS! the Series C "WASP"

Millions of miles of flying with the "Wasp" engine in commercial, Naval and Military operation, under all possible conditions, ranging from the frigid temperatures of Northern Canada to the other extreme of torrid tropical conditions, has created an invaluable fund of experience.

With this background and without radical departure from previous practice, our Engineering Department has developed and thoroughly tested the Series C "Wasp." This model has even better performance characteristics, greater dependability, and longer life than its predecessors.

We thoroughly believe that the Series C "Wasp" is the nearest approach to mechanical perfection yet obtained in any aeronautical engine. We invite you to inspect it at the Detroit Show.

THE
PRATT & WHITNEY AIRCRAFT CO.
HARTFORD CONNECTICUT

Manufactured in Canada by the Pratt & Whitney Aircraft Co., Ltd., Longueuil, Quebec; in Continental Europe by the Bavarian Motor Works, Munich.

Wasp & Hornet Engines